

THURSDAY, MAY 19, 1887.

LOCAL NAMES OF BRITISH BIRDS.

Provincial Names and Folk-Lore of British Birds. By the Rev. Charles Swainson, M.A. Published for the English Dialect Society. (London, 1885 [sic]).

The Folk-Lore and Provincial Names of British Birds. By the Rev. Charles Swainson, M.A. Published for the Folk-Lore Society. (London, 1886.)

INEPTITUDE for the performance of a literary task has long been held by some publishers to be no bar to a man's undertaking it; but we believe that hitherto this opinion has not been shared by publishing Societies. These bodies may not always have been fortunate in the selection of editors or authors; but in a general way it may be asserted that a grave mistake is seldom made. Such a mistake, however, it is our unhappy lot now to record, and it is the more marked in that it is common to two of them—the English Dialect Society and the Folk-Lore Society. Most of the publications of the former are everywhere recognized as possessing high value—some naturally are better than others; but each of them has reflected credit upon the Committee of that Society, formed as it is of some of the best English scholars, and its work has undeniably been of great use. With the publications of the latter the present writer must avow himself inadequately acquainted, though he is willing to accord to them a reputation not inferior to that which those of the sister Society enjoy. By what perverse fate, then, these two Societies have combined to intrust a subject so exceedingly interesting, and of which it was possible to make so much, as the “Provincial Names and Folk-Lore of British Birds,” to a gentleman whose knowledge of it is obviously inadequate, is beyond the reviewer's power to explain. Perhaps it may be only one of those well-known results of divided responsibility which are almost invariably exhibited in statesmanship, generalship, and editorship. A more unsatisfactory work than that of which the double title stands above has seldom appeared on the counter of a careless publisher, and of this fact the Committee of the English Dialect Society seems, when too late, to have become aware; since its thirteenth Report, read at the annual meeting on February 14 last, contains what cannot be looked upon as otherwise than an apology for the course into which it was led. Here we read—

“Mr. Swainson's ‘Provincial Names of British Birds’ has been published in conjunction with the Folk-Lore Society, at whose instance it was undertaken. . . . The work is interesting, and the list of local names is the best yet published; but it is only right to point out that, in the catalogue given by Mr. Swainson of the books which he has consulted for the purposes of his compilation—about one hundred in all—not a single publication of the English Dialect Society is mentioned. This means, of course, that the words used in almost fifty counties or districts have been entirely overlooked and neglected. Several recent monographs on the ornithology of English counties, most of which contain the local names of the birds, are also omitted from Mr. Swainson's list. . . . It is obvious, therefore, that the Dialect Society, whilst acknowledging their indebtedness to Mr. Swainson for the work he has done, can only regard it as a partial

and temporary treatment of the subject; and they will be pleased if they could induce Mr. Swainson or some other member to attempt the compilation of an exhaustive and final list of local bird-names.”

This free acknowledgement goes far to exonerate the Committee from their offence, into committing which they would seem to have been dragged by the Folk-Lore Society. Whether the Council of the latter body has expressed itself in any corresponding terms, the present writer is not aware; but that some explanation is due to its members, if they are above caring for anything more than a parcel of old wives' fables indifferently told, is very clear.

That the compiler of a successful list of provincial names of birds should be somewhat of a philologist and somewhat of an ornithologist would seem to be obvious. There is little evidence to show that Mr. Charles Swainson is either one or the other, and a good deal to make us suspect that he is neither. Moreover, we cannot free ourselves from an uncomfortable thought that he has not personally consulted some of the works he quotes, for he certainly “makes hay” with their authors' names and the titles of the books, while he is not above citing a passage at second-hand from a popular author who may or may not have correctly reproduced the original passage—a passage that may or may not occur in any very rare or recondite volume. Furthermore, besides the omissions noticed in the Report just cited, there is a considerable amount of material available which has been wholly passed by. The earlier volumes of the *Zoologist* contain several lists of the local names of birds that seem to be unknown to him, and from those lists, and others there collected, it was many years ago fondly hoped that a gentleman—the Rev. J. C. Atkinson—who, by his later labours, has proved his efficiency, would have compiled a work having the same scope as that now before us.

It does not appear to have occurred to Mr. Swainson that a name has not only a locality, but a history, and that, though information concerning the locality in which it is used is very desirable, information concerning its history is more important still. In regard to the former, what he tells us is generally little enough; and in regard to the latter, what he tells us is generally nothing at all. More than this, the source of such information on either subject as he does vouchsafe is very rarely indicated—still more rarely than is done by M. Rolland, whose “Faune Populaire de France” (a very good book in its way, but one capable of great improvement) is confessedly the model which the work before us tries to copy.

To take the first species in Mr. Swainson's list (p. 1), which species, by the way, he calls by the corruptly abbreviated name “Missel Thrush.” He writes of “the fondness of this bird for the berries of the mistletoe, holly, and holm.” If he had looked at the careful “Dictionary of Plant-Names” of Messrs. Britten and Holland (published by this same English Dialect Society), or almost any British Flora, he might have seen that holly and holm are synonyms, instead of being, as he would have them, the names of different trees. He also tells us that among the names which this bird has received, from the harsh note it utters when alarmed, is that of “Screech”; but he gives not a hint to connect that word with its undoubted parent form, the Anglo-Saxon *Scric*, which is rendered *turdus* in

the older vocabularies, and is, there can be little question, the early form also of "Shrike," though that was by one of Turner's friends applied to a wholly different kind of bird, which since 1544 has borne it, in books at any rate. Indeed this last species (*Lanius excubitor*) has a very doubtful claim to any English vernacular name at all, though its common congener may rejoice in that of Butcher-bird. But even under "Shrikes" we have no reference to the Anglo-Saxon *Scric*, and we may remark that here (p. 47) we find a passage, some four or five lines in length, inclosed in inverted commas, as though a quotation, and followed by "(Yarrell)," as if the naturalist of that name were its author. Truth compels us to say that search in all the editions of Yarrell's classical work has failed to show that the so-printed quotation is anything but a paraphrase, and a very inadequate one, of the passage Yarrell wrote.

Coming to Mr. Swainson's second species, the Song-Thrush (p. 3), we find no attempt to trace the nice distinction which runs through more than one Teutonic tongue between Thrush and Throstle—the latter being the diminutive of the former, as Prof. Skeat's "Dictionary" shows, and our author is content to quote Macgillivray at second-hand from Mr. Harting, whereby an accidental error (slight, but enough to give the passage a wrong meaning) is repeated. Space fails us to criticize what else Mr. Swainson says of these two species alone, and of course it would be impossible to go through the whole of his volume in this way, even if we wished to do so. Suffice it to say that there is scarcely a page to which exception of one kind or another could not be taken, and now let us turn to the very end of the book. Here (p. 217) in what he says of the last but three of the species in his list we find the astounding statement that from the French word *Guillemot* (corresponding with the same in English) comes the Welsh *Guillem*! This is enough to make any patriotic inhabitant of the principality go off his head, for though doubtless the words have a common origin, the derivation, if such there be, must be the other way, and the modern French *Guillemot* be the offspring of the Cymric and probably Breton *Gwillim*, or *Gwyllym* as Pennant wrote it. On the next page, Mr. Swainson gives us a piece of information as curious and, we fear, unwarranted, telling us that the names Greenland Dove and the like (applied to what in books is called the Black—but here by accident misprinted "Lack"—*Guillemot*) are bestowed on account of "the great attachment shown to each other by the male and female, thus resembling the dove." Ornithologists knew that in one of its plumages the Tysty is very dove-like, but we think they did not know, and, if they believe it, will doubtless be thankful to Mr. Swainson for the news, that it is remarkable for conjugal affection! We should doubt whether the Rotch, or Little Auk, was ever called by Icelanders "*álka*," for by that name, when properly spelt, they mean the Razorbill; and, arriving at the last bird in the list, we are concerned to find that the Puffin is "so called either from its puffed-out appearance, or from its swelling beak." Setting aside the fact that no one who has ever examined the compressed "coulteneb" of the Puffin could reasonably apply thereto the epithet "swell-

ing," we may remark that the name seems to have been first applied to the young birds in their downy clothing, which, when salted and dried, were held in some estimation as an article of food, and were described by Gesner in 1555 ("Hist. Avium," pp. 110, 768), from an account furnished to him by Caius, as wanting true feathers, and being covered only with a sort of woolly black plumage—natural "powder-puffs," in fact. It is true that Caius himself, fifteen years later ("Rarior. Animal. Libellus," fol. 21) declared that the name is derived "a naturali voce pupin"; but that assertion will not be confirmed by those who know the bird in life. Mr. Swainson would no doubt have mentioned these particulars had he known them, and he might easily have found them out by searching for the earliest record of the species; but, as before remarked, investigation is a quality in which he appears to be singularly deficient.

There may be readers who will condone such blemishes as those of which we have given some half dozen instances out of—we should be sorry to say how many that we could notice. Several far more flagrant than those we have particularized have attracted attention elsewhere,¹ and are therefore purposely passed over by us; but before we leave the subject we should like to say a few words on the distinction which exists between *real* and what we may perhaps call *book* names—a distinction in no way heeded by our author. To use the phrase of Sir Hugh Evans, these last are "affectations." They may or may not be needful, they may or may not be apposite, and they may or may not be adopted into our language; but they are artificial grafts, and not its natural outgrowth. Consequently, from the linguistic and philological point of view, the difference between the two classes of names should be always most carefully drawn, and the more carefully since, in some cases, the child of adoption puts on an appearance amazingly like that of the child of generation. To show this difference an investigation of the history of names is needed; but that is not attempted by Mr. Swainson. Few persons would suspect that the name "Dipper," which of late years has in common use almost wholly ousted the Water-Ousel, Water-Crow, or Water-Pyot of former days, was not of very ancient origin, and referred to that bird's habit of diving below the surface of a stream in quest of its prey, as indeed is stated by Mr. Swainson (p. 30). Yet, directly we inquire into the history of the name, we shall be unable to trace it beyond 1804, when it was apparently introduced by the writer of the work known as "Bewick," and also find that it was applied because the bird "may be seen perched on the top of a stone in the midst of the torrent, in a continual dipping motion, or short courtesy often repeated." Here the need of explanation is all the greater, because this particular sense of the word "dip" or "dipping"—though familiar enough to our forefathers, has become almost obsolete, and, indeed, is passed over by Prof. Skeat. "Dipper," therefore, is nothing but a book-name. Then, again, under "Hedge-Sparrow"—a name which must last so long as Shakespeare is read—we have, amid half a dozen genuine local synonyms, "Hedge-warbler, Hedge-accantor, Hedge-chanter" brought in, as if they were ever employed except by a few crotchety writers, who tried to confine the use of the word Sparrow in

¹ In older French, *Guillemot* was applied to a Plover, as by Belon in 555.

² *Athenæum*, March 19, 1887, pp. 386-387.

a way that not many English words will brook, and certainly not a word of such wide meaning and acceptance as this. In the same way the book-names of the Stone-Curlew—Thickknee, Norfolk Plover, and the rest, to the number of half a dozen—are gravely printed as if they were "provincial"; and here we may remark that Mr. Swainson applies (p. 200) the Arabic name of this species "*Karrewan*" (as he prints it) to its namesake the Long-billed Curlew or Whaup, which must be wholly unknown to most of the descendants of Ishmael.

We very much regret that we have to express ourselves in such terms of this book. We doubt not that the author has done the best that in him lies, and we are especially sorry to find from his preface that the delay in its appearance (for it had been long looked for) is due to his ill health. It is on this last account that we are indisposed to drive home many charges of carelessness which might easily be established, and we part from him trusting that in another edition he may have the opportunity of justifying his selection by these two learned Societies for the duties that we strongly suspect he must already regret having undertaken; but to do this he should acquire some knowledge of the ways and looks of birds, and learn the rudiments of etymology.

RECENT WORKS ON THE THEORY OF DETERMINANTS.

Primeiros Principios da Theoria dos Determinantes. Por J.-A. Albuquerque. (Porto, 1884.)

Die Determinanten in genetischer Behandlung. Von Adolf Sickenberger. (München, 1885.)

Vorlesungen über Invariantentheorie. Bd. I. Determinanten. Von Paul Gordan. (Leipzig, 1885.)

Elements der Theorie der Determinanten. Von Paul Mansion. 2te vermehrte Auflage. (Leipzig, 1886.)

An Elementary Treatise on the Theory of Determinants. By Paul H. Hanus. (Boston, 1886.)

Beiträge zur Theorie der Determinanten. Von Wilhelm Schrader. (Halle, 1887.)

THREE of these works are introductory text-books of from fifty to eighty pages, and may consequently be dismissed in a few lines. The first is a skilfully arranged and well-written manual, furnished with suitable exercises, and ought to be found exceedingly serviceable in the secondary schools of Portugal. That by Prof. Mansion, of Ghent, has already been referred to in NATURE; the fact that it is now in the fourth French edition and second German edition is sufficient proof of its value. The third, by Gymnasial-Professor Sickenberger, is the largest and yet the most elementary, having been intended (not very wisely, we are disposed to think) for pupils very imperfectly prepared in algebra. Twelve pages, including a collection of thirty exercises, are devoted to determinants of the second order, thirty-eight pages to those of the third order, and the remaining thirty pages to determinants in general, the whole being prepared with endless pains and much preceptorial skill. Introductory works of this kind have for a number of years been appearing in Germany at the rate of 1.3... per annum: in England we have not had one since 1875.

Our insular way of doing things, however, is so different from that of the Germans that it may be fairly questioned whether we are any the worse for the deficiency. It would certainly be very erroneous to conclude that the advance of the theory of determinants in the two countries during the period referred to has shown the same marked contrast.

Gordan's "*Vorlesungen*" is a book on the lines of Salmon's "*Modern Higher Algebra*." The theory of determinants is consequently not taken up in its entirety, the design having been to give the main propositions regarding general determinants and to include the discussion of only those special forms which are connected with the chief subject of the work—to give, in fact, such a knowledge of determinants as would enable the student to prosecute investigation in the theory of invariants. It is nevertheless a very full exposition—much fuller than Salmon's, and much more methodical. The section on Permutation and Substitution should be carefully noted: although in essence it dates from the time of Cauchy, it will be none the less fresh to many readers.

"*Beiträge*" is rather a misnomer for the remaining German work on our list. The book is nothing more nor less than an ordinary, or very ordinary, *text-book*, containing three chapters, the first on determinants in general, the second on the adjugate determinant, and the third on determinants of special form. The author attaches considerable importance to a new notation which he introduces and uses throughout, and to various new theorems which he enunciates and proves; indeed, the title-page bears the intimation, "*Neue Sätze und eine neue Bezeichnung*." The said new notation is obtained by placing the lengthy but excellent umbral notation—

$$\left| \begin{array}{cccc} 1, & 2, & 3, & \dots, & n \\ 1, & 2, & 3, & \dots, & n \end{array} \right|$$

atop of another notation, which is itself none too compact, viz. $D(a_{i,k})$, the outcome being

$$D(a_{i,k}) \begin{array}{c} 1, 2, \dots, n \\ 1, 2, \dots, n \end{array}$$

It is a little hard to see that this piling of Pelion on Ossa results in "grössere Einfachheit." As for the new theorems, we are satisfied that the author will change his mind in regard to them as his range of reading widens. All the results on pp. 98–111, for example, are perfectly well known in England and America: indeed, the whole of them which concern alternants of the third order are included in a single theorem of Prof. Woolsey Johnson's. None the less credit, however, is due to the author for the work he has done; and we trust that, having examined the literature of his subject, he will continue his investigations and attain a more enduring success.

The new American text-book stands out in marked contrast with the preceding. First of all, it is a book of good outward appearance; paper, printing, and binding being unexceptionable. In the second place, the author makes no pretensions to originality: in his preface he enumerates a few manuals, English and Continental, to which he is indebted, and frankly states that he has used them all freely. Some of them, we should say, he has used more freely than others, but, on the whole, with good judgment, and in such a way as to show that he

possesses an independent grasp of the subject. The only notable instance of lack of insight is in the section on continuants, where two pages (pp. 179, 180) are unintentionally devoted to proving the theorem—

$$\frac{mA}{mB} = \frac{A}{B}$$

this very theorem itself being employed in the proof. Mr. Hanus will doubtless yet come to see that the book in which this originally appeared requires to be perused in a spirit of scepticism rather than of faith. We may note also that the identity (5) on p. 37 is exactly the same as (3) on the preceding page, that the footnote on p. 196 is misleading, and that the investigations referred to on p. 199 might with advantage have been further drawn upon. These latter, however, are small points which can be attended to in the second edition. The book, on the whole, is trustworthy, and well adapted for College use. On this account, and as being the first American text-book on the subject, it deserves a cordial welcome both in America and in Britain.

THOMAS MUIR.

OUR BOOK SHELF.

The A B C of Modern Photography. 22nd Edition. (London: The London Stereoscopic and Photographic Company, 1887.)

ALTHOUGH this is called a new edition, it is really a new book, having been reconstructed and much new matter added. Those who are about to begin photography cannot do better than study and carry out the instructions which are here clearly stated. The book is divided into two parts.

In Part I. the beginner is taken through the whole process—exposing, developing, printing, &c.—and this is followed by tables of weights and measures.

Part II. contains good accounts of all the advanced parts of the art, such as re-touching, portraiture, &c., together with chapters on photo-micrography, instantaneous photography. One of the latest developments of photography is shown in the "detective book camera," which has the appearance of an octavo book of a thickness corresponding to about 200 pages. The new method of taking negatives on paper is fully described. Lastly, under the headings of "New Apparatus and Processes," Rayment's patent tripod top is mentioned, which allows the camera to be pointed in any direction, and also the patent photographic Gladstone bag, which is fitted up so as to contain a complete photographic outfit. We must not omit to say that the book is fully illustrated, the frontispiece being a photo-mezzotype taken by a pupil of the Stereoscopic Company.

Newcastle-upon-Tyne Public Libraries. Supplementary Catalogue of Books added to the Lending Department. (London: G. Norman and Son, 1887.)

IN this supplement the compiler has given nearly as much space to 10,000 volumes as was occupied by twice that number in the catalogue published in 1880 (see NATURE, vol. xxiii. p. 262). Most of the works have been published since 1880, but some earlier books have also been added. The rapid accumulation of knowledge makes it extremely difficult to provide adequate references to the subjects of pamphlets and of articles in treatises and serial publications. The compiler has, however, recognized the importance of this part of his work, and the results of the labour he has devoted to it will be of real service to students who may have occasion to consult the supplementary catalogue.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

Thought without Words.

I DO not see that Prof. Max Müller's theory of the inseparability of thought from language, whether true or erroneous, has any important bearing on the origin of man, whether by evolution or otherwise. It is a question at all events to be studied by itself, and to be tested by such experiments as we can make by introspection, or by such facts as can be ascertained by outward observation.

My own opinion is strongly in favour of the conclusion urged by Mr. F. Galton. It seems to me quite certain that we can and do constantly think of things without thinking of any sound, or word, as designating them. Language seems to me to be necessary to the progress of thought, but not at all necessary to the mere act of thinking. It is a product of thought; an expression of it; a vehicle for the communication of it; a channel for the conveyance of it; and an embodiment which is essential to its growth and continuity. But it seems to me to be altogether erroneous to represent it as any inseparable part of cognition. Monkeys and dogs are without true thought not because they are speechless; but they are speechless because they have no abstract ideas, and no true reasoning powers. In parrots the power of mere articulation exists sometimes in wonderful perfection. But parrots are no cleverer than many other birds which have no such power.

Man's vocal organs are correlated with his brain. Both are equally mysterious because they are co-operative, and yet separable, parts of one "plan."

ARGYLL.

Argyll Lodge, Kensington, May 12.

HAVING much of the same experience as Mr. Galton, I nevertheless prefer dealing with a larger group of facts. I have often referred to the mutes of the seraglio at Constantinople, who cannot be charged with thinking in words. They have their own sign conversation among themselves, and which has no necessary reference to words. Even the names of individuals are suppressed among themselves, though they sometimes use lip reading to an outsider to make him understand a name. Anyone having a knowledge of sign language is aware that it is independent of words. The tenses of verbs, &c., are supplied by gestures.

The mutes are not deficient in intelligence. They take a great interest in politics, and have the earliest news. It is true this is obtained by hearing, though they are supposed to be deaf-mutes, but among themselves everything is transmitted by signs.

HYDE CLARKE.

32 St. George's Square, S.W., May 12.

I THINK that all who are engaged in mechanical work and planning will fully indorse what Mr. Francis Galton says as to thought being unaccompanied by words in the mental processes gone through. Having been all my life since school-days engaged in the practice of architecture and civil engineering, I can assure Prof. Max Müller that designing and invention are done entirely by mental pictures. It is, I find, the same with original geological thought—words are only an incumbrance. For the conveyance and accumulation of knowledge some sort of symbols are required, but it appears to me that spoken language or written words are not absolutely necessary, as other means of representing ideas could be contrived. In fact, words are in many cases so cumbersome that other methods have been devised for imparting knowledge. In mechanics the graphic method, for instance.

T. MELLARD READE.

ON reading Mr. Galton's letter, I cannot help asking how Prof. Max Müller would account for early processes of thought in a deaf-mute: does he deny them?

S. F. M. Q.

Scorpion Virus.

I AM much obliged to Sir J. Fayrer for pointing out a mistake in my paper on this subject in the Proceedings of the Royal Society of January 6, 1887. In referring to his experiments I remarked, "They show conclusively that the cobra poison will not affect a cobra, and will not even affect the viperine *plyas*." "*Plyas*," was written by mistake for "*Daboia*."

I take the opportunity of recording an observation with regard to the slight power scorpions possess of withstanding the heat of the sun's rays. If a scorpion is placed in an open pie-dish in the sun (the experiments were tried in Madras on an averagely hot day), it will run violently round and round, lash its sting about, and then gradually become torpid; this happens in from seven to ten minutes. If then removed into the shade, it will gradually recover; but if left for longer in the sun, it dies. As the scorpion is an inhabitant of hot countries, this sensitiveness to the sun's rays is very remarkable.

A. G. BOURNE.

Madras, April 13.

Weight and Mass.

I FIND it convenient to distinguish in writing between mass and weight by using the symbols *gr.* or *kgr.* or *lb.* to denote masses, and reserving capital letters *Gr.*, *Kgr.*, &c., where weights, or forces in gravitation measure, are understood; say, 50 *kgr.* of stone, or wood, or iron—1000 *Kgr.* denoting a stress in some structure or the like. Some agreement in these notations would be desirable.

W.

Lemberg, May 14.

Dynamical Units.

IN reference to this subject may I remark that the proposed term "*cel*" is etymologically incorrect for the meaning intended to be conveyed? It might stand as a contraction for "*celerity*," *i.e.* velocity, but not for the rate of increase of velocity. The essential distinction between velocity and acceleration is wholly expressed in the prefix "*ac*." If we must cut all our words down to one syllable, the "*ac*" would really have in it more correct meaning than the "*cel*."

Early in 1886, Prof. D. H. Marshall, of King's University, Kingston, published a book on dynamics, in which he uses the word "*tach*" to mean unit velocity of one centimetre per second. He has no special name for the unit of acceleration, but the unit of momentum he calls a "*gramtach*," and the unit rate of doing work a "*dyntach*." The unit pressure-intensity of one degree per square centimetre he calls a "*prem*."

I would like to suggest that names for the units might be formed systematically by the addition to the ordinary name for the quantity of the invariable affix "*on*," which is the root part of the word "*one*." Thus as unit names we would employ "*velociton*" or "*velon*"; "*acceleron*" or "*accelon*"; "*momenton*"; "*presson*"; "*tenson*," &c., &c. For the sake of uniformity we might change "*radian*" into "*radion*."

Birmingham, May 4.

ROBERT H. SMITH.

Monkeys opening Oysters.

So many people have expressed their surprise at hearing that I constantly saw monkeys breaking open oysters with a stone on the islands off South Borneo, that it may be of interest to give a short description of their method of using such a tool.

The low-water rocks of the islands of the Mergui Archipelago are covered with oysters, large and small. A monkey, probably *Macacus cynomolgus*, which infests these islands, prowls about the shore when the tide is low, opening the rock-oysters with a stone by striking the base of the upper valve until it dislocates and breaks up. He then extracts the oyster with his finger and thumb, occasionally putting his mouth straight to the broken shell.

On disturbing them, I generally found that they had selected a stone more apparently for convenience in handling than for its value as a hammer, and it was smaller in proportion to what a human being would have selected for a proportionate amount of work. In short, it was usually a stone they could get their fingers round. As the rocks crop up through the low-water mud, the stone had to be brought from high-water mark, this distance varying from 10 to 80 yards. This monkey has chosen the easiest way to open the rock-oyster, viz. to dislocate the valves by a blow on the base of the upper one, and to break the

shell over the attaching muscle. The gibbon also frequents these islands, but I never saw one of them on the beach.

ALFRED CARPENTER.

Marine Survey Office, Bombay, April 14.

Zirconia.

OUR attention has been drawn to a letter in NATURE, vol. xxxv. p. 583, written by Mr. Lewis Wright. He makes the statement that we supplied him with a sample of zirconia as "*pure*," which, upon examination, he found to contain silica, as well as some soda, rendering the sample quite useless for the purpose for which it was required.

We trust you will allow us to correct this statement. We sold the zirconia as "*impure*," and when Mr. Wright asked us to purify it further for him, declined to do so. We told him that it was an article obtained as a residue produced during the preparation of another body, and was sold, in consequence, at a price far lower than the usual price at which the article can be produced in a pure state.

HOPKIN AND WILLIAMS.

16 Cross Street, Hatton Garden, London, E.C.

Sunspots.

DR. VEEDER is perfectly correct in his letter appearing in NATURE, vol. xxxv. p. 584, in his description of the tiny group of spotlets which were seen on November 15, 16, and 17. The complete record of spots for the month of November 1886 appears to have been as follows, the areas of the spots being expressed, as in the Greenwich results, in millionths of the sun's visible hemisphere.

Date.	Number of spots.	Total area.
November 12	1	7
" 13	1	9
" 14	2	8
" 15	1	1
" 16	2	5
" 17	2	12
" 26	1	6

The mean daily area of these seven days, the only days in the month showing spots, was only 7 millionths, and for the month as a whole, 1.6 millionths. The exceptional character of the month will be better seen when it is remembered that the Greenwich results give 24 millionths as the mean daily area for 1878, the year of minimum; whilst at maximum, as in 1883, the mean daily area was 1155.

With reference to the "*six days*" which Dr. Veeder quotes from the note on "*Solar Activity in 1886*," appearing in the Astronomical Column of NATURE, vol. xxxv. p. 445, the assertion was based on a record which was defective for three or four days. The group he describes as making its first appearance on December 8 was not seen here until December 10, and had only become important by December 12. Since the appearance of Dr. Veeder's letter, I have been privileged to inspect the series of photographs taken in India and in the Mauritius, under the auspices of the Solar Physics Committee. These show that the group had not come into view at the east limb until after the photographs on December 8 had been taken, so that, for Europe and Asia, December 9, which was cloudy here, was practically the first day of the spot.

THE WRITER OF THE NOTE.

"The Game of Logic."

IN the course of a review of Lewis Carroll's "*Game of Logic*" (p. 3), Mr. A. Sidgwick says incidentally that "*In Mr. Venn's scheme propositions either tell us that a compartment is empty or tell us nothing about it.*" This is not quite correct; he should have confined his statement to *universal* propositions. It is quite true that on the schemes of Boole and Jevons nothing is recognized but 0 and 1; nothing but the excision of a combination and the letting it stand; and they both make the attempt to express particular propositions with such resources. But I have taken particular pains to show that such a scheme of dichotomy will not suffice to represent affirmatives and negatives, universals and particulars; and that for this purpose, when we are dealing with logic on the compartmental

theory, if we intend to grapple with every kind of proposition we require a threefold division. We must be able to show that a compartment is empty, that it is occupied, or that we do not know what is its state.

Speaking only of diagrammatic illustration, since it is to this that Mr. Sidgwick is referring, I may say that I have indicated in an article in *Mind* (1883, p. 599) how such a threefold scheme of alternatives could be displayed. Reference to this will be found also in Mr. Keynes's "Formal Logic."

I cannot ask for space to discuss the subject fully here. But I would remark that any scheme that confines itself to two alternatives seems to me to be necessarily open to one or other of two serious drawbacks. Either (1) we have to assume that the assertion of a proposition carries with it the existence of its subject. This begins plausibly enough; but when fully worked out it forces us to abandon various universally recognized rules, such as some of those for conversion, contraposition, &c. It also, in the case of complex propositions, departs even further from convention than the opposite doctrine does. And it wholly fails to express hypothetical propositions. I have pointed out these difficulties in my "Symbolic Logic," and the first of them will be found very fully treated by Mr. Keynes. Or (2) we may reject the assumption just mentioned, as Boole and Jevons practically do. We are then wholly unable (in spite of the attempts made by each of these writers) to express particular propositions.

Cambridge.

JOHN VENN.

THE PARIS ASTRONOMICAL CONGRESS.

IN our last article we brought down our reference to the *procès-verbaux* as follows:—General Congress meeting, April 19; Photographic Committee meetings, April 20 and 21; Astronomical Committee meetings on the 20th, 21st, and 22nd. We have since then received from Admiral Mouchez the following records:—Third and fourth meetings of the Congress on the 23rd and 25th; meeting of the Permanent Committee on the 26th; and meeting of the Permanent Bureau on the 27th. The two final meetings of the Congress were held chiefly to receive the reports of the Astronomical and Photographic Sub-Committees which have been appointed, and to whose proceedings we have referred in detail, and also to appoint a Permanent Committee, and if necessary a Bureau.

It will be convenient, then, that we should commence by referring to the third and fourth general meetings held on the 23rd and 25th. This first meeting considered the various resolutions which had been arrived at by the Sub-Committees, and the discussions upon them do not appear to call for any more remarks upon our part. With regard to the construction of the object-glass for the light near G, the eminent optician, Steinheil, communicated a note which will appear among the records of the Congress, but of which no details are given in the *procès-verbal*. With regard to the supplementary negatives which are to be obtained for purposes of a catalogue of the stars of reference, the Astronomer-Royal was evidently under the impression that to endeavour to obtain stars of the eleventh magnitude might be going a little too far, and he therefore proposed that a resolution should give authority to the Permanent Committee to determine down to what magnitude, not beyond the eleventh, these photographs should include. The Astronomer-Royal also was evidently under the impression that the Congress had been called together to obtain a photographic autobiography or map of the heavens in this present century chiefly, and that it should not lay so much stress as the astronomers present were inclined to do upon a mere catalogue.

Mr. Gill, Her Majesty's Astronomer at the Cape, seems to be of a different opinion, as he remarked that it is necessary to make a catalogue if the thing is possible. The number of stars to appear in the catalogue if the eleventh magnitude is adopted will be about 1,500,000

according to M. Paul Henry, and according to Dr. Schoenfeld, if the 11.5 magnitude were adopted no less than 3,500,000 stars. Subsequently the matter was put to the vote, and the resolution as it came down from the Astronomical Section was approved, Mr. Christie's amendment being lost.

The Congress next passed on to consider the distribution of work among the different Observatories. MM. Beuf and Cruls, representing the Observatories of La Plata and Brazil, were the first to reply that they were ready, it being understood that the price of a telescope similar to that employed by the Brothers Henry would be something like 40,000 francs. Admiral Mouchez stated that it had been decided that the Observatories of Algiers, Bordeaux, Paris, and Toulouse would represent the part which the French Government would be prepared to take, and he also stated that in all probability the Observatory of Santiago in Chili could undertake some portion of the work. M. Weiss stated that the participation of the Vienna Observatory might be regarded as certain. MM. Tacchini and Oom, representing the Observatories of Rome and Lisbon, had little doubt that their Governments would furnish the requisite sums. M. Dunér stated that the Senate of the University of Helsingfors would contribute a photographic refractor, and he did not anticipate any difficulty with his Government. M. Struve had no instructions; M. Auwers was in the same case; Messrs. Christie and Gill followed suit. Mr. Russell declared that in his opinion the necessary funds would be provided to enable the co-operation of the Observatories of Melbourne and Sydney to be assured. Mr. Peters said that he had no doubt that there would be ten Observatories in America anxious to help in the work, but he did not know if they would accept all the terms and conditions of the resolutions of the Congress. M. Pujazon, representing Cadiz, thought that he could promise assistance towards the map, but he could promise nothing relating to the catalogue.

M. Foli, representing Brussels, then proposed the following resolution:—

"If an astronomer takes, by means of a telescope different to that suggested by the Committee, photographs which fulfil the conditions laid down for the map, he shall be able, with the concurrence of the Permanent Committee, to join in the execution of it."

This was subsequently withdrawn.

The final meeting of the Congress was held on the 25th, and the point first discussed was that relating to the Permanent Committee. M. Knobel proposed, on behalf of some of the French astronomers, the following resolution:—

"That there should be two categories of members in the Permanent Committee—first, the Directors of Observatories where the work is carried on; and secondly, others not necessarily taking part in the construction of the map. This Permanent Committee should name its own Bureau, consisting of a President, two Vice-Presidents, and two Secretaries."

Next followed a discussion as to the number of members of which the Committee should consist. A considerable difference of opinion was made manifest by the remarks of many members of the Committee, and Admiral Mouchez, with the apparent intention of coming to an agreement, proposed the following series of resolutions:—

(1) "Before separating, the International Congress shall delegate its powers to a Commission of eleven members, forming an Executive Commission, charged to study all the questions which have been referred to, and to hasten the preparations for the execution of the map as much as possible. The Directors of Observatories

who shall obtain from their Governments instruments constructed according to the decisions adopted by the Congress shall take part in the work and be members of the Commission."

(2) "The Executive Commission shall meet once a year in one of the cities named beforehand where one of the Observatories is situated. Those members who cannot take part in this reunion shall forward their remarks upon the principal questions to be discussed, of which the President of the Commission shall give notice one or two months beforehand."

(3) "Between these annual meetings, the President should keep himself in communication with the members, and receive or give advice on all matters touching the preparation or execution of the work and the progress already effected."

(4) "The division of the heavens between the different Observatories, and all questions not settled by the Congress, must be fully studied in advance, so that they may be decided in a definite way, at least in two years' time, at a meeting in 1889, by which period many instruments will be ready to begin work."

On the occasion of the Universal Exhibition, Paris will probably be the city most convenient for this second meeting.

(5) "While the map is in progress, each Director who takes part in the work shall send to the Permanent Committee one or two months before each meeting, stating the work done, together with any remarks which he may consider necessary."

(6) "The *procès-verbaux* of these annual meetings, and the resolution of all work done, shall be published regularly, and sent to each Observatory."

The President, M. Struve, asked if M. Knobel would withdraw his resolution in favour of that of Admiral Mouchez. Finally, after some discussion, part of M. Knobel's resolution was carried, all except that portion relating to the constitution of the Bureau.

It was next determined that the number of members of the Permanent Committee, beyond those Directors of Observatories who have declared their readiness to join at once, should be eleven. The members elected were Christie, Dunér, Gill, Paul Henry, Janssen, Lœwy, Pickering, Struve, Tacchini, Vogel, Weiss.

The following resolution was next carried, proposed by M. Auwers:—

"The Congress resolves that it is desirable to appoint a Sub-Committee occupying itself with the application of photography to astronomy, other than the construction of the map, showing the importance of all these applications and the relations which it is important to establish between these different kinds of work. This Committee should place itself in relation with the Permanent Committee. The Congress desires that MM. Common and Janssen be charged to carry out this resolution."

The thanks of the Congress to the French Government, Admiral Mouchez, and the President, M. Struve, brought the Congress to a close.

The first meeting of the Permanent Committee was held on April 26, M. Struve in the chair; M. Trépied was requested to act as Secretary. Much time was spent in discussing whether a Bureau or Sub-Committee should be appointed, although the relation of this Bureau or Sub-Committee to the Permanent Bureau appointed at the last meeting of the Congress does not come out very clearly. Admiral Mouchez stated that the Bureau to be elected at the present meeting was rather an Executive Committee than a deliberative one. This was generally agreed to. The composition of the Bureau was then fixed at one President, five Members, and three Secretaries, and the members elected were as follow:—Presi-

dent: Admiral Mouchez; Members: Messrs. Struve, Christie, Tacchini, Dunér, and Janssen; Secretaries: Gill, Vogel, and Lœwy. M. Vogel then suggested that his colleagues on the Permanent Committee should present to the Bureau before July 1 next any propositions they might have, concerning experiments to be undertaken, and other preparatory work. He suggested also that the Bureau should be allowed to confide directly to men of science, possessing special knowledge, some of the researches which the International Congress has left to the Permanent Committee the responsibility of undertaking and directing.

After discussion of all the documents thus received, a definite plan of preparatory work might be elaborated and distributed among the different Observatories. Admiral Mouchez then stated that the Academy of Sciences would bear all the expenses of printing connected with the work, and it was also agreed that all documents should be sent in French. The Astronomer-Royal was requested to undertake experiments with curved plates. M. Struve promised in a month's time to forward suggestions relating to the methods of proceeding to be adopted by the Bureau. It was further decided that all memoirs and communications should be addressed to the President, and distributed by him and the Secretaries residing in Paris.

The last question discussed was the probable number of Observatories. Mr. Gill remarked that the small number of Observatories in the southern hemisphere were almost all situated in the same latitude, and he suggested that if France would establish a new Observatory in the Island of Réunion or New Caledonia, probably the Government of New Zealand might establish another in that colony. The general opinion was that the Island of Réunion would be better than New Caledonia as a station, and that the Observatory in New Zealand should be built in latitude about 48° S. The following resolution was unanimously adopted:—

"The Permanent Committee of the International Astronomical Conference met together for the construction of a photographic chart of the heavens, and finding that the number of Observatories in the southern hemisphere was insufficient for the good and prompt execution of the work, expressed a desire that two new Observatories might be erected, at least as a temporary measure, one in New Zealand, the other in the Island of Réunion."

The President was charged with the duty of transmitting this resolution to the English and French Governments.

Finally, we come to the Bureau of the Permanent Committee, which held its first sitting on April 27, M. Struve being President.

Mr. Gill announced that Sir James Anderson, Director of the Eastern Telegraph Company, has provisionally authorized the exchange of free telegrams between the Cape and Paris. Thanks were unanimously voted to Sir James Anderson for this offer. All members of the Committee were requested to reply within a month to any question addressed to them, and six was made a quorum. Mr. Gill volunteered to draw up complete instructions regarding all photographic operations. The assistants appointed to conduct the photographic work in the Observatories now taking up photography for the first time are to be trained in Observatories where photographic work is already carried on.

The institution of a series of test objects was then agreed to, and Messrs. Gill, Vogel, and Henry, were requested to draw up a list. On the proposal of Admiral Mouchez, the following distribution of the experimental work was agreed to:—

(1) Systems of cross-wires.—M. Vogel.

(2) Photographic magnitudes.—Messrs. Struve and Pickering.

(3) Optical determinations of images by means of photographs supplied by the Brothers Henry.—M. Struve.

(4) The study of three or four stars nearly in a straight line embracing the total angular distance of about 1°, and photographed necessarily at the centre and at the corner of a plate.—Paris, Algiers, Pulkowa, and Leyden.

(5) Study of the deformations of films.—Algiers, Meudon, and Potsdam.

(6) Study of curved plates from the triple point of view of construction, means of covering with a film, and measures.—Mr. Christie.

(7) Study of absolute orientation—that is to say, the mounting of the plates in the photographic telescope.—The Cape and Paris.

(8) Study of the measuring-instruments to be applied for the future utilization of negatives.—This was postponed.

(9) The study of formule for the preparation of plates in accordance with the general rules laid down by the Conference.—Messrs. Abney and Eder.

(10) Opinions of colours of stars on their photographic magnitudes.—M. Dunér.

THE TEMPERATURE OF THE CLYDE SEA-AREA.¹

II.

FROM the curves for each station, temperature sections were constructed for every cruise, showing the position of the isotherms with relation to a profile of the bottom along certain lines. It is not easy to give an intelligible description of the distribution of temperature without reference to those diagrams; but an attempt may be made. The most important section runs from the Channel, across the Plateau, up the Kilbrennan Sound branch of the Arran Basin, through Inchmarnoch Water, to the head of Loch Fyne. It is sufficient to recollect that the Plateau is covered by about 25 fathoms of water, that the depth increases on the inside up to 107 fathoms off Skate Island, then diminishes rapidly to 15 fathoms at Otter and Minard, and increases again to nearly 80 in Upper Loch Fyne. The section is a little more than 90 miles long.

In April the whole section was filled with water between 41°·3 and 44°. The water of the Channel, the Plateau, and the surface layers (to 10 or 20 fathoms) was above 42°. The average bottom temperature was 41°·3, except in the Channel (42°), and in Upper Loch Fyne (41°·9). The June section shows marked surface heating to a depth of about 5 fathoms. Water at 47°·5 filled the Channel, covered the Plateau, and extended in a layer of about 5 fathoms thick over the inner reaches. The great mass of water was between 44°·5 and 44°. In Upper Loch Fyne the remarkable distribution of temperature, referred to when discussing the curves for Strachur, was found to extend from Minard to the head of the Loch, in the form of a lenticular mass of water of temperature under 44°, with warmer water above and below. The minimum temperature, 42°, was found off Inveraray at a depth of 30 fathoms, and the gradient of temperature was much steeper in the upper layers of the cold mass than in the lower. No satisfactory explanation of the mode of formation of this intermediate minimum of temperature has yet been arrived at, and any suggestions as to its origin would be received with interest. In August the section shows that the cold mass remained in the same position but with a rather higher temperature, and of much smaller dimensions. As in previous months, the warmest water was that nearest the Atlantic, which had a temperature of over 53°. The great Arran Basin presented a considerable range; from 54° on the surface to 50° at 20 fathoms, 48° at 30, 46° at 60, and 45°·3 on the bottom. The September cruise showed a very similar

state of matters, accompanied by a general rise of temperature and an increase in thickness of the warmer layers. As in each previous month, the Channel was warmest (54°·5 throughout), and the warm surface layer became thinner and thinner until at Otter the surface temperature was under 53°. The section clearly shows, what careful experiments have proved, that the abrupt rise of the sea-bottom, from off Skate Island at 107 fathoms to Otter at 15, is characterised by a rise of colder water from beneath to the surface. The gradient at this place is 550 feet in ten sea-miles, or 1 in 100; and perhaps vertical circulation is set up as much by the sudden narrowing of the Channel, as by its shoaling. A similar effect was observed at Row Point in the Gareloch, and at the narrowest part of the Kyles of Bute. In September the bottom temperature of the Arran Basin was 47°·5, that of Upper Loch Fyne 44°·2; the intermediate minimum had disappeared from the latter. November showed the influence of surface cooling in a marked degree. The Channel and Plateau had cooled down to 50°, and for the Arran Basin the average surface temperature was 49°·5, that at the bottom 51°·5. This shows a great equalisation of temperature, and a reversal of the summer conditions, the warmer water being now below, the cooler on the surface. In Upper Loch Fyne the temperature was 44° at surface and bottom, but a maximum of a little over 50° was found at 15 fathoms. Further cooling and greater equalisation of temperature characterised December; the Channel was warmest, at 48°·5; the whole Arran Basin varied from 46°·8 on the surface to 47°·5 on the bottom; and Loch Fyne maintained its independent position by a quite new arrangement of temperature-layers. On the days of our work there (December 29 to 31) the whole upper part of the Loch was covered with a sheet of frozen fresh water, the ice being nearly half an inch thick in places. Three inches beneath the ice the temperature was 36°, and a few feet under, it was 44°. The maximum temperature of 47°·5 was met at 20 fathoms; and the warm layer of water was giving out its heat to the superficial strata, being cooled by this winter's cold, and to the lower mass which still retained the cold of last winter, although the bottom temperature had risen about half a degree since November. In February it was impossible to observe in the Channel on account of bad weather, but the water on the Plateau was slightly colder (43°·4) than that in the Arran Basin (43°·7 to 44°). There was little range of temperature, the surface being in all cases, however, slightly colder. Throughout the Arran Basin the temperature of the mass of water was the same as in June: this may be held as pointing to the end of April as the period of minimum. Loch Fyne showed a steady rise of temperature as the depth increased down to 45 fathoms, where the thermometer registered 46°·5; from that point to the bottom there was a fall to 45°·8.

Dividing the Clyde sea-area into three parts, each comprising regions of like physical configuration, the direction of the annual march of temperature may be summed up thus.

Starting from the simple case of a minimum uniform distribution, the Channel heats uniformly up to September, and then cools uniformly; the strong tidal currents, or some other cause, keeping the water thoroughly mixed, and equalising all heat transactions.

The deep open basins, to which the tide has free access, heat up most rapidly on the surface, and more uniformly lower down; the mass which heats uniformly decreases until at the period of maximum there is an unbroken fall of temperature from surface to bottom, and a considerable range. Then, at the autumnal equinox, the surface water begins to cool, while summer heat is still travelling downwards: this leads to the typical winter state—exactly complementary to the summer condition—of a uniform gradient of temperature rising from surface to bottom, but with a slight range. As winter goes

¹ Continued from p. 39.

on, the rate of cooling becomes more nearly equalised, and on approaching the spring minimum the whole mass of water is at one temperature, and cooling steadily throughout.

The deep inclosed basins differ from the deep open basins only in degree; but in the same direction as the deep open basins differ from the Channel. On this matter I do not care to speak with so much certainty; as, the conditions in the inclosed basins being much more complicated, there is more probability there than elsewhere of local and temporary disturbances being mistaken for the normal progress of events. It appears, however, that summer heating takes place more slowly throughout the mass, although the surface maximum is earlier; and that in the deep, comparatively still water there may be at one time the conjoint effects of more than one summer and winter.

One step further in the direction of conditioning the phenomena of temperature in water is to entirely cut off even superficial tidal communication with the ocean; to form, in fact, a deep inland lake. Observations made by Mr. Buchanan, Mr. Morrison, and myself, on Loch

Lomond and Loch Katrine, show that there the annual march of temperature is very much what might be expected from the Clyde observations; but there is the great difference of the water being fresh, and having a maximum density-point varying with the depth, which prevents a rigid comparison being made.

From the temperature sections, which have been described, the average temperature of the whole mass of water for each trip was deduced, by measuring the areas occupied by each range of 2° , multiplying these by their respective mean temperatures, adding the results together, and dividing by the number representing the whole area of the section. In order to ascertain the temperature of the surface water, that of the superficial 2 fathoms was calculated in the same way. By the kindness of Mr. Buchan, of the Scottish Meteorological Society, I was supplied with the mean monthly air temperature (average of twenty-four years) of the Clyde sea-area, and the deviations from the average for each month from January 1886 to February 1887. The figures are given in the accompanying table, and are expressed graphically by curves in Fig. 4.

MEAN MONTHLY TEMPERATURES 1886-87.

	January	February	March	April	May	June	July	August	September	October	November	December	January	February
Mean air temperature ...	$39^{\circ}5$	$40^{\circ}0$	$41^{\circ}5$	$46^{\circ}0$	$50^{\circ}5$	$58^{\circ}0$	$58^{\circ}0$	$58^{\circ}0$	$54^{\circ}5$	$48^{\circ}5$	$42^{\circ}5$	$40^{\circ}0$	$39^{\circ}5$	$40^{\circ}0$
Deviation for 1886-87 ...	$-3^{\circ}5$	$-4^{\circ}0$	$-2^{\circ}5$	$-1^{\circ}5$	$-2^{\circ}5$	$-2^{\circ}5$	$-1^{\circ}0$	$-1^{\circ}0$	$-0^{\circ}5$	$+2^{\circ}5$	$+2^{\circ}5$	$-4^{\circ}0$	$-2^{\circ}5$	$-$
Temperature of a surface fathoms ...	$43^{\circ}0$	$43^{\circ}0$	$43^{\circ}0$	$43^{\circ}0$	$49^{\circ}0$	$49^{\circ}0$	$49^{\circ}0$	$53^{\circ}4$	$53^{\circ}0$	$53^{\circ}0$	$50^{\circ}0$	$48^{\circ}7$	$48^{\circ}7$	$44^{\circ}0$
Average temperature of water ...	$41^{\circ}7$	$41^{\circ}7$	$41^{\circ}7$	$41^{\circ}7$	$44^{\circ}8$	$44^{\circ}8$	$44^{\circ}8$	$48^{\circ}7$	$48^{\circ}7$	$48^{\circ}7$	$48^{\circ}7$	$48^{\circ}7$	$48^{\circ}7$	$44^{\circ}0$

The temperature of water is not the monthly mean, as in the case of air, but that at the time when observations were made.

This shows that the year in which our observations have been made is rather an unfortunate one; because the low temperature of spring and summer, and the high temperature of autumn tended to retard the heating and the cooling of the water so as to produce a curve much flatter than the normal one may be expected to be. The maximum of air temperature occurred between July and August, that of the surface water between August and September, and of the whole mass of water apparently in October. The air and the whole mass of water from surface to bottom had the same mean temperature about the beginning of October; after that date the water remained warmer than the air, and the whole mass of water than the 2 superficial fathoms. It is specially noticeable that, while during heating the surface water is far above the main mass in temperature, it is only a very little below it during cooling.

Knowing the mass of water in the sea-area under consideration, it is easy to convert the temperature data into terms of heat; and, using for convenience the unit of one ton of sea-water raised 1° Fahrenheit in temperature, the following table expresses the actual changes taking place:—

QUANTITY OF HEAT.

Trip.	Commenced	Ended	Interval from last	Change of mean temp.	Average change per day	Total change of heat	Average change of heat per day
			days	$^{\circ}$	$^{\circ}$	millions	millions
April	13th	21st	8	$+3^{\circ}1$	$+0^{\circ}39$	$+465,000$	$+7,000$
June	16th	22nd	6	$+3^{\circ}9$	$+0^{\circ}65$	$+535,000$	$+11,600$
August	4th	12th	8	$+3^{\circ}3$	$+0^{\circ}41$	$+435,000$	$+10,000$
September ..	22nd	29th	7	$+1^{\circ}4$	$+0^{\circ}20$	$+210,000$	$+4,000$
November ..	11th	19th	8	$-3^{\circ}9$	$-0^{\circ}49$	$-535,000$	$-14,000$
December ..	23rd	31st	8	$-2^{\circ}7$	$-0^{\circ}34$	$-405,000$	$-9,600$

To summarise the above and give an account of heat transactions, it is sufficient to say that from April to

September there was a gain of 1,545,000 million ton-degrees, corresponding to a rise in average temperature of $10^{\circ}3$; while from September to February there was a loss of 1,200,000 million ton-degrees, corresponding to a fall in average temperature of $8^{\circ}0$, thus leaving 343,000 million ton-degrees of heat to be expended by April next, supposing the water to return to the state in which it was

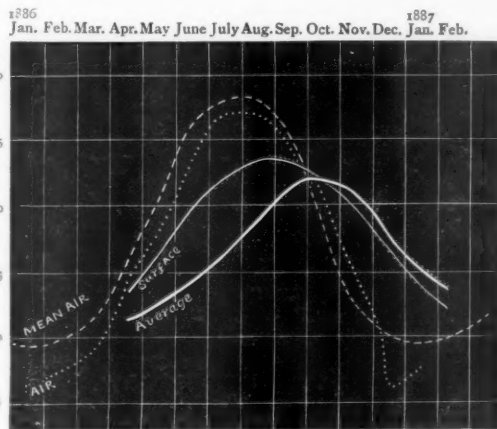


FIG. 4.—Clyde Sea-Area. Annual march of temperature.

in April last. These numbers for heat are of course based to a considerable extent on assumptions, and must only be taken as part of the preliminary discussion of the exact observations already recorded.

Observations made from March 25 to April 3, since the greater part of this paper was in type, show a general

temperature of about $43^{\circ}5$ over the whole area, and confirm all the provisional conclusions stated above. The figures observed in the three typical positions are as follow:—

	Place Date	Channel. March 30.	Off Skate Island. March 28.	Strachur. March 29.
Temp. surface	...	$44^{\circ}7$...	$43^{\circ}8$
„ bottom	...	$44^{\circ}2$...	$45^{\circ}5$

From the forms of the curves the spring minimum appears to be past, and over all the temperature is about $2^{\circ}5$ higher than at the same period last year. The water in Upper Loch Fyne is now cooling at the bottom and heating again on the surface, the range for the year at great depths having been only 4° . The actual change of temperature in the sea-area between the beginning of February and the end of March is very slight, but it is significant in showing by its direction that the period of minimum lay between the two.

One interesting application of the observations may be made to climatology. A great proportion of the heat gained is derived not from solar radiation, or the contact of heated air with the surface, but from the warm Atlantic water entering by the tides. Since the water on the Plateau appears to remain warmer than that inside all the year round, no heat is lost to the Atlantic in winter; but all must be radiated off from the surface or employed in evaporating water or heating air by contact, and in this way more heat is returned to the air of the Clyde sea-area in winter than was received from it in summer. Another observation may be mentioned which serves to show how important a bearing temperature observations may have on biology. On February 4, four tow-nets were used off Strachur at different depths: one at 70 fathoms, one at 50, one at 30 fathoms deep, and the fourth at the surface. There was nothing in the surface-net, and the surface temperature was 43° . The contents of the other three nets were examined by Mr. David Robertson, of Millport, who reports:—"In all three nets Copepoda were moderately abundant. The nets at 70 and 30 fathoms contained one and the same species; but the contents of the net at the middle depth were different, confined to an abundant species of copepod loaded with ova (*Euchaeta norvegica*). With them there were two or three adult schizopods (*Nyctiphanes norvegica*). At 70 fathoms the temperature was $45^{\circ}9$, at 30 fathoms $45^{\circ}6$, and at the position of the middle net $46^{\circ}3$. Mr. Robertson concludes: "As the middle water of the loch at this time is shown to be warmer than either the layer above or below, we may reasonably assume that the species in ova sought the warmer layer." Similar observations repeated at many different places during the March trip showed the same result, the minute Crustacea being most abundant where the temperature was highest.

The work is being carried on meanwhile, purely as a piece of physical and meteorological research, and a considerable time must necessarily elapse before all the latent meaning of the great mass of figures now being accumulated can be brought to light. There is no doubt that when the problem of the interchanges of heat in comparatively deep water has been made out, important practical applications to other sciences, and to some arts and industries, will be discovered.

HUGH ROBERT MILL.

SCIENCE AND GUNNERY.¹

II.

LAST week we pointed out the great advantages which accrue from retiring guns behind inconspicuous parapets, and mentioned that the energy of the discharge had been utilised to raise the guns again into the firing position without the aid of extraneous power.

¹ Continued from p. 37.

The theory of the discharge of cannon involves many interesting considerations, not only with respect to the strength and structure of the guns but also with reference to the force required to control the recoil. A gun may be considered as a heat engine of the simplest construction, performing its work in one stroke. The fuel used is gunpowder, and the energy developed is, as in other engines of this class, in proportion to the weight of fuel used and to the heat it is capable of developing. The main difference between explosives and most other fuels is that explosives are complete in themselves; that is to say, they burn independently of the presence of extraneous bodies, and that consequently the chemical union which causes the explosion takes place simultaneously throughout the mass and in an exceedingly short time.

Fuel in large masses burns slowly because the air, which forms its complement, can come into contact with only limited surfaces, but if reduced to fine powder the combustion may be made to assume almost the intensity of an explosion, as for example in the dust-fuel used in Crampton's furnace, and the dusty atmosphere of coal-mines and flour-mills.

The materials in gunpowder, intimately mixed throughout, are in a state of unstable equilibrium with respect to each other; a very moderate increase to the thermal movement of the molecules causes them to clash together with sufficient energy to insure combination, and if such increase of motion be communicated to one portion of the explosive by the application of percussion or of a hot body, it is carried through the mass by the luminiferous ether with all the rapidity with which radiant energy travels, and the increase of motion, sufficient to cause combination, is communicated to every molecule nearly simultaneously, the consequence being a change of form and volume produced with the suddenness which marks an explosion. We believe that Mr. Anderson was the first, in his lectures on heat at the Society of Arts, to point out that it is unfair to compare the calorific value of fuels in their incomplete form; that is to say, that such fuels as require air for combustion should have the necessary weight of air added to them, and when that was done the singular fact appeared that the quantity of heat evolved by most combustibles per unit of weight was very nearly the same; thus in nine cases cited, which included coal, coke, wood, petroleum, illuminating gas, and gunpowder, the extreme variations from the mean calorific value did not exceed 9 per cent. In the same lectures it was shown that in guns, as in most heat-engines, a very large proportion of the thermal energy of the fuel was dissipated in a useless manner; in the case of cannon more than half was wasted in heating up the gun, and about one-third only in producing recoil, which was the reaction to the energy communicated to the shot, to that imparted to the powder gases, and to the work of displacing the atmosphere. Of these three effects only the energy imparted to the shot was known with precision, for by means of sufficiently simple apparatus it was possible to determine with great accuracy the velocity with which the projectile left the gun, and the energy therefore was easily determined by multiplying half its mass by the square of that velocity.

The determination of the work done in expelling the powder gases was more difficult to estimate. In the first place, only about 43 per cent. of the products of the combustion of gunpowder are in the state of gas, the remaining 57 per cent. are in the form of very finely-divided solids; next, the combustion goes on nearly all the time that the shot is travelling out of the gun, the pebbles of powder igniting in succession, a fact which is proved by the circumstance that in short guns a good deal of powder is blown out without being consumed at all, and it is doubtful even whether in the modern long guns combustion is always complete. While the shot is travelling along the chase, the centre of gravity of the powder charge is moving also

at an uncertain rate, but the moment the shot leaves the gun the whole of the products of combustion appear to spring out with a velocity equal to, if not greater than, that of the shot. The evidence of this supposition is found in the fact that in the case of disappearing guns fired with their muzzles close to a masonry parapet, and in which the recoil below it is completed in a small fraction of a second, no blackening of the masonry is noticeable. A portion of the gases follow the shot and keep up with it for a considerable distance, as is shown by the circumstance that smoke issues plentifully from the earth banks into which proof shots at short range are fired, proving that the smoke of the discharge must have followed the shot into the tunnel momentarily made and as quickly obliterated by passage of the projectile through the earth. It is evident that the velocity with which the gases issue must depend upon the pressure in the gun at the moment of the shot leaving the muzzle, and this pressure again depends upon the volume of the bore, the weight of powder consumed, and the final temperature, the latter depending partly upon the expansion and the consequent heat converted into work.

The final temperature of the gases can only be conjectured: it probably does not exceed a bright red heat, or between 1200° C. and 1400° C. absolute; and knowing that one pound of powder at 0° C. and standard barometer develops about 4.43 cubic feet of gas, it is possible to estimate what the final pressure in the gun should be. Given, however, a barrel full of gas at a definite pressure, we are not in a condition to say what energy its expulsion would generate; and the assumption that the mean velocity will be that due to a body falling from a height equal to that of a column of gas of uniform maximum density which would correspond to the observed pressure would probably be as accurate as any other. On that assumption the velocity of the gas would be 4544 times the square root of the product of the final pressure in the bore in tons per square inch into its volume in cubic feet divided by the weight of the powder in pounds, and, this velocity determined, the energy is, of course, at once arrived at.

The displacement of the atmosphere also forms a very considerable item. The expansion on leaving the gun being instantaneous, the pressures and temperatures fall approximately as in adiabatic expansion; hence it is easy to calculate what probable temperature and consequent volume the gases will assume as they stream out of the gun, and this temperature is comparatively low; otherwise powder smoke would be insupportable to those feeling its influence close to a gun. The work done in displacing the air is found by multiplying the volume pushed aside by the atmospheric pressure. A small portion of this work is performed as the shot travels along the chase, but the greater part is done after it leaves the muzzle. The energy of the reaction to the sudden liberation of gases under high pressure is but too familiar to us in the case of boiler explosions, in which it commonly happens that great masses of material are hurled with destructive force and often to great distances.

The pressure-curve inside the gun is still very ill-defined; the forms commonly given are certainly a long way from the truth, because the areas included, which form indicator diagrams representing the work done, will not account for the energy developed. The pressure probably falls in proportion to the distance travelled by the shot, and the time in which the discharge takes place may be calculated on that assumption, or even with sufficient accuracy on the supposition that the velocity of the shot is uniformly accelerated as from the action of a constant force equal to the mean pressure producing the known velocity of the shot in a known distance. The easiest way to take account of all the forces causing recoil is to ascertain the velocity of the

combined powder and projectile which will possess the total energy of discharge calculated, and then to equate the momentum of the gun and moving parts of the carriage to that of the shot and powder. In the case of a carriage receding along a slide, this operation is a very easy one, but when a Moncrieff mounting has to be dealt with, the case becomes very complicated, the gun moves along a curved path, the sides and counterweights have a rolling motion, and it becomes necessary to calculate the path of the centre of gyration, and determine the virtual weight concentrated in the gun, and a similar process has to be followed in the case of the massive levers which carry the guns in hydro-pneumatic mountings.

Recoil consists of two parts: first, the period, a very brief one, in which the velocity of recoil is got up; and secondly, the period in which the energy so acquired by the parts in motion is more slowly absorbed or dissipated. The first part of recoil must necessarily occupy the same time as the discharge, that is to say, a small fraction of a second, because acceleration can only go on so long as the accelerating force is acting, but that force is the pressure of the powder gases on the base of the bore, and the pressure only lasts while the discharge is taking place. The motion of the whole system of gun and carriage does not, however, coincide with the motion of the shot. In all but very long guns the shot has left the barrel before the motion of the muzzle commences; during the time of discharge, perhaps the $1/50$ part of a second, the gun is being stretched by the inertia of its forward end and of the carriage resisting the tendency to put them into motion, but the reaction to this stretching carries on the acceleration of recoil a little after the shot has left the gun. The pressure on the parts during this period is very severe, the work done being exactly the same as that performed by the shot, the powder, and the displacement of the atmosphere. The full speed of recoil is attained, not only in a very short time, but in a very restricted space, rarely more than 3 inches, and the difficulty in constructing carriages may be said to lie in providing for the violent strains which produce a velocity of some 20 feet a second in the great mass of the gun and carriage in the exceeding short time and space named. The momentum of the moving parts of the system being equal to that of the ejected charge, the velocity is readily calculated, and generally ranges between 16 and 30 feet per second, and their energy is then easily ascertained.

In the counterweight Moncrieff carriages, which have been made for short muzzle-loaders up to 9-inch calibre and twelve tons weight, the whole mass set in motion is so great compared with the energy of the discharge, that the gun sinks below the parapet with a comparatively slow and stately movement; but, with the long breech-loaders and heavy charges, with the comparatively light moving parts which characterise hydro-pneumatic mountings, the motion is very violent, and requires great strength in the parts to resist the strains. In addition, the gun describes a circular path, and by the time the maximum velocity of recoil is attained, sufficient centrifugal force is engendered to produce a sudden upward pull, which has to be met by arrangements for holding the carriage down to the masonry of the emplacements. The longer the arms which carry the gun, the less this tendency is, because the pull of centrifugal force is inversely as the length of the radius of the curve described by the trunnions. The front of the carriage has generally to be held down for another reason. The gun, when fired, is high above the base of the mounting; the mechanism, self-contained in the carriage, for absorbing recoil, offers a certain amount of resistance to the backward movement of the gun, hence a couple is established which tends to turn the carriage over on its rear wheels, and this tendency varies with the height of the gun and the length of the base.

In the hydro-pneumatic system the fall of the gun actuates a ram or piston working in a cylinder full of water, and communicating by an automatic valve, opening outwards from the cylinder, with an air-vessel about two and a half times the capacity of the ram, and filled with air compressed to a degree sufficient not only to support the weight of the gun, but also to raise it quickly into the firing position. When the gun is up, the air-vessel is nearly empty; when down, a volume of water equal to that of the ram displaces the air and increases its pressure, and the ratio of the fall of the gun to the stroke of the ram, and the relative velocities of the two, are so adjusted that the increase of air-pressure corresponds to the increasing leverage which the gun acquires as it descends.

It is possible to provide sufficient air-pressure not only to arrest the fall of the gun, but also to absorb the energy of recoil; but unless the gun is allowed to fall a very great distance this is not necessary, and any excess energy can be more conveniently absorbed by regulating the opening of the recoil-valve so as to throttle the water in its passage from the cylinder into the air-vessel. At first sight it might be assumed that, saving friction of the mechanism, the air-pressure which would suffice to check the fall of the gun would be sufficient to raise it again; but a little consideration will show that this is not the case. To allow the gun to fall in the short space of time during which recoil takes place, the pressure of the air must be less than that necessary to support the gun, because its pressure rises nearly according to the ordinates of an adiabatic curve, the temperature rising in exact proportion to the work done. During the time the gun is being loaded, the heat developed in the air is dissipated, so that when the gun requires to be raised the store of heat is gone, and the air, expanding, falls in temperature by the amount of heat converted into the work of raising the gun; the pressure consequently falls.

To meet these two sources of loss, amounting to the heat corresponding to the work of the gun falling twice the height to which it rises and falls, the energy of the discharge has to be drawn upon; it compresses the air far above its isothermal line, although that line is so fixed as to yield sufficient heat for conversion into the work of raising the gun. In addition, the energy of discharge has to provide the means of overcoming the friction of the machinery which resists the falling of the gun, and again resists its rising, so that, taking all the sources of loss enumerated together, the energy of recoil of even our most powerful guns is not adequate to do more than allow them to fall some 8 or 9 feet, an amount, however, sufficient for the most ample protection.

It will be readily seen that the construction of a disappearing carriage offers a number of problems of great scientific as well as practical interest. We have only dwelt upon some of the most prominent points. There remain the strains on the elevating gear, which is arranged so as to bring the gun into the same loading position, irrespective of the angle at which it is fired, and has, therefore, to communicate a sudden rotatory motion to the gun; the resistance of the levers and elevating-bars to the cross strains caused by their own inertia when brought into sudden motion sideways; the resistance offered to the water in its passage at variable velocities from the cylinder to the air-vessel, the accelerating force to be provided to raise the gun in a given time, and many minor problems which tax to the full the application of mathematics to the design of machinery.

THE TOTAL SOLAR ECLIPSE OF AUGUST 19, 1887.

THE total eclipse of the sun which will occur on August 19 next, though only of average duration, will offer exceptional opportunities for observation from the circumstance that the track of the moon's shadow

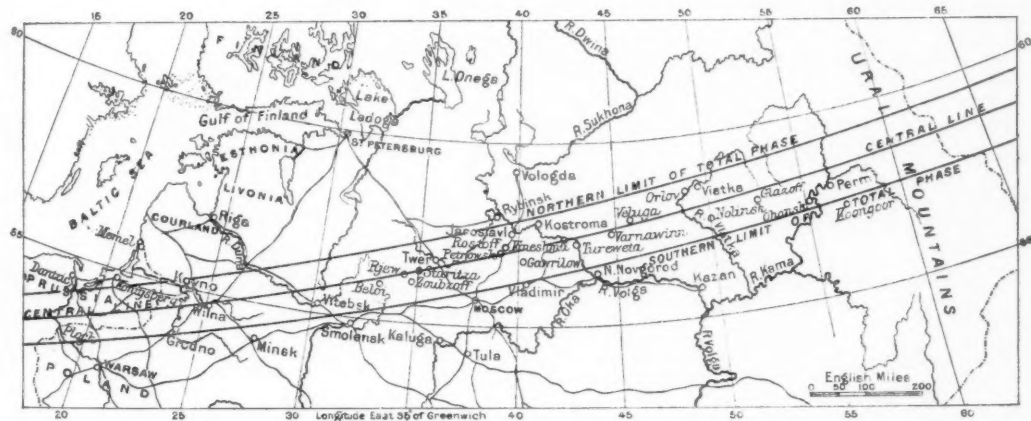
will be almost entirely a continental one, in striking contrast to the eclipses of the last four years, in all of which the shadow has followed a course which has been principally over the great oceans. The eclipse is technically a partial one for the principal part of Great Britain, but as it will be nearly over before sunrise, it will practically not be visible here. The middle phase will have been reached at sunrise, for places a little to the west of Berlin: and this city lying within the path of the shadow, it is just possible that it may be favoured with a sight of the phenomena of totality, though with a sun close to the horizon; for the sun will be largely obscured as it rises, and will not be quite 3° high at the end of the total phase. From Prussia the shadow track passes into Russia, and the central line does not leave the borders of the Russian Empire until it reaches East longitude 112° . It then crosses Manchuria and the Sea of Japan, and cuts the principal island of the Japanese group a little to the north of the capital. The final portion of its course lies over the North Pacific Ocean, and except for the little island of Rico de Oro, it does not touch land again. But the path of totality not only lies mainly over land, a large number of important towns are either actually included within, or lie very close to its limits. Königsberg lies just outside. Kovno, Wilna, and Vitebsk, are well within the shadow; Wilna being nearly on the central line. At these towns, however, the sun will still be too low for them to afford desirable stations for observations, and probably the neighbourhood of Moscow will be the nearest district which will be occupied by astronomers. At Moscow itself, the eclipse will not be quite total, since that city lies just outside the southern edge of the shadow-track, but three lines of railway radiating from Moscow will afford easy access to places actually on the central line. The most westerly of these three railways is that which unites St. Petersburg with the older capital, and which passes through Twer. Twer is nearly on the central line, but a little to the north of it. The sun will have an elevation of about 16° in this neighbourhood, and the maximum duration of totality is not quite two minutes and a half. At Twer itself it will be only 124 seconds. Three parties, two German, and one French, will take up positions within the Government of which Twer is the capital. The second line runs from Moscow to Vologda, passing through Jaroslavl, which lies within but near the edge of the shadow. Petrowsk on this railway is very near the central line, and here the sun will be 2° higher than near Twer, and the duration 152 seconds. The third line runs to Kineshma, which is itself very near the central line. Here the sun will be about 20° high, and the total eclipse on the central line will last 156 seconds. It will not, however, be difficult to proceed to yet more favourable positions further east. From Moscow there is a line through Nijni Novgorod to Kazan, and a service of river steamers runs thence up the River Kama to Perm. Perm lies to the south of the central line, but the totality lasts there 173 seconds, whilst the sun is 28° high at mid eclipse. If the weather should be favourable, Perm would be therefore a very suitable station for those astronomers who can spare the time to journey so far; for others the neighbourhoods of Petrowsk and Kineshma will afford readily accessible sites. Prof. Bredichin, Director of the Moscow Observatory, has his own private observatory only two kilometres from Kineshma, and very close to the central line; and he has generously offered the hospitality of his house to the Royal Astronomical Society for two English astronomers, an offer which has been gratefully accepted by the Society, on behalf of Dr. Copeland and the Rev. S. J. Perry. Prof. C. A. Young also will have his station here, and a strong party of Italian and English astronomers, consisting of Profs. Tacchini and Riccio, and Messrs. Common and Turner, will be located at no great distance away, in the neighbouring Government of Vladimir.

The eclipse being visible in Europe and from places so readily accessible from England, no Government Expedition will be sent out to observe it. It is not probable, therefore, that any English astronomers will go so far east as Siberia. It may be hoped that Russian astronomers will make good this defect, especially as four of the principal towns of Siberia lie on the shadow-track—Tobolsk, Tomsk, Krasnoïarsk, and Irkutsk; the first and third being close to the central line, and the sun being eclipsed when nearly on the meridian at Irkutsk. A series of Siberian stations is the more to be desired, since, as Prof. D. P. Todd has pointed out in the *American Journal* for March, this eclipse offers an exceptionally favourable opportunity for a concerted scheme of observation. The path of totality coincides in a most remarkable manner with the lines of the Russian overland telegraph, so that it will be perfectly possible to select a series of stations in telegraphic communication with each other, and extending over a line of 100° of longitude, with an extreme difference in the absolute time of totality of more than an hour and a half. It appears, Prof. Todd learns from a letter from Dr. S. von Glasenapp, that the Russian telegraph service may be expected to give the use of its lines at the time for astronomical purposes. It is certainly to be hoped

that so unique an opportunity may not be lost; for it might well happen that some discovery, either in solar research, or of a comet or intra-Mercurial planet, might receive in this manner the most satisfactory confirmation and development.

The eclipse may also be well observed in Japan. On the west coast, Niigata, one of the Treaty ports, lies well within the shadow on the north, and Takata, a large manufacturing town, on the south, the central line passing through the large fishing-village of Idzumosaki, on the high road between the two. The Island of Sado, opposite to Niigata, which is free to foreigners, is wholly within the shadow, the central line crossing Sawa Umi Bay. The totality here lasts 198 seconds, with a sun 37° high. On the east coast the important town of Mito lies almost precisely on the central line. The duration here will be 192 seconds, and the sun 35° high. Japan, indeed, offers advantages for observing stations superior to those of Perm, as the sun will be considerably higher, and the duration 20 to 25 seconds longer.

The following formulæ, computed by Woolhouse's method (*Nautical Almanac*, 1836), from the elements of the eclipse given in the *British Nautical Almanac*, will supply the means for the computation of the beginning



and ending of the total phase for any place not far from Perm, lat. 58° 8' N., and long. 55° 12' E.:—

$$\cos w = 52.926 - [1.89540] \sin l + [1.42842] \cos l \\ \cos (L - 68^\circ 25' 1'');$$

$$t = 17\text{h. } 40\text{m. } 13\text{s.} \mp [1.94168] \sin w - [3.20536] \sin l \\ - [3.85031] \cos l \cos (L - 19^\circ 47' 9'');$$

And for determination of the latitudes of the central line, and of the north and south limits of totality in the longitude of Perm:—

$$n \cos (N + l) = \begin{cases} - [1.73180] & \text{for N. limit;} \\ - [1.72367] & \text{for central eclipse;} \\ - [1.71538] & \text{for S. limit.} \end{cases}$$

$$n \cos N = [1.42842] \cos (L - 68^\circ 25' 1'');$$

$$n \sin N = [1.89540].$$

As in similar formulæ given in NATURE for previous eclipses l is the geocentric latitude, L the longitude from Greenwich counted positive towards the east, and t results in Greenwich mean solar time. Quantities within square brackets are logarithms, not simple numbers.

Similarly for places near Idzumosaki, lat. 37° 38' N., and long. 138° 49' E., we have:—

$$\cos w = + 53.9763 - [1.84932] \sin l \\ + [1.53239] \cos l \cos (L - 24^\circ 51' 1'');$$

$$t = 17\text{h. } 32\text{m. } 24\text{s.} \mp [1.99243] \sin w - [3.45091] \sin l \\ - [3.85537] \cos l \cos (L + 10^\circ 4' 7'');$$

And for central line and limits:—

$$n \cos (N + l) = \begin{cases} - [1.74018] & \text{for N. limit;} \\ - [1.73220] & \text{for central eclipse;} \\ - [1.72408] & \text{for S. limit.} \end{cases}$$

THE STEERING OF H.M.S. "AJAX."

WHEN H.M.S. *Ajax* was first sent to sea, her steering qualities were found to be very defective, especially at high speeds, the most objectionable and perplexing characteristic of her behaviour being a tendency to require a large angle of helm to keep her on a straight course. This helm tendency was sometimes on one side and sometimes on the other, generally remaining the one or the other for some time unchanged, but occasionally changing sides without warning or apparent cause. On such occasions, at full speed, the ship had been found to fly off her course at a right angle before she could be mastered by reversing the helm.

In a lecture on this subject, lately delivered before the Royal United Service Institution, Mr. R. E. Froude summarised as follows the causes to which such behaviour might be colourably attributed in ships of the type of the *Ajax*, namely, flat-bottomed and full-ended, particularly in the run: (1) want of "directive character" (as he phrases it)

of hull, from the flatness of bottom and fullness of ends; (2) weakness of action of rudder, from its position in the dead-water; (3) an active turning force, consisting in a one-sided pressure on the stern arising out of a one-sided system of flow in the water closing in behind the full run. It was principally to the last-mentioned cause that Mr. Froude, when called upon to investigate the case of the *Ajax*, was inclined to attribute the behaviour of the ship, such a phenomenon having been some years since incidentally observed in the course of experiments made in the experiment tank at Torquay on the resistance of a model having a full run. In this case a lateral force was found to be developed upon the stern of the model, accompanied by a trailing away of the wake to one side, and a transverse flow of the water across behind the stern, in the opposite direction to that in which the lateral force was developed. This one-sidedness of flow, and consequent force (like the helm tendency of the *Ajax*), was sometimes in one direction, and sometimes in the other, and occasionally reversed its direction during any experiment; but was generally more or less persistent in direction when initiated, although the direction in which it was initiated was apparently a matter of accident. It was Mr. Froude's belief, founded on these and many other experiments of various kinds, that this species of, so to speak, spasmodic one-sidedness of flow, and consequent one-sided force, attends the motion of all, even perfectly symmetrical, bodies through water, whenever their leaving lines are blunt enough to cause a large eddy behind them.

By way of a method of experiment suitable to test the effect of remedies designed to mitigate or remove either of the three presumable causes of the behaviour of the ship, which have been enumerated above, Mr. Froude towed a model of the *Ajax* in the experiment tank at Torquay, the model being attached to the towing carriage in such a way that, while the model was free to sheer out of the straight course, any such attempted sheering motion actuated a working rudder fitted to the model, in the proper direction for frustrating the attempt. By this contrivance the model was made to steer quite straight, and the criterion of the badness of the steering qualities of the model in the several conditions of trial subjected to experiment, was the amount and the degree of unsteadiness of the helm angle administered, this helm angle being continuously recorded throughout each experiment by an automatic apparatus. Thus tested, the model was found to exhibit conspicuously what has been referred to as the predominant characteristic of the behaviour of the ship, viz. the large helm angle, sometimes persistently on one side, sometimes on the other, and occasionally changing from one side to the other.

The principal remedies tentatively applied to the model with a view to identifying the main source of the evil, and indicating the direction in which improvement was to be sought, were these: (1) a deep keel, to supply "the directive character" in which the hull itself was presumably lacking; (2) placing the rudder altogether below the keel, so as to be quite clear of the dead-water; (3) an extensive dead-wood (or fixed rudder) behind the stern-post, (the working rudder being still below the keel), to frustrate the one-sided flow behind the stern, and do away with the consequent turning force. Of these three kinds of remedy the last-named proved much the most effective, proved indeed an almost perfect cure, thereby confirming the surmise that the one-sided flow at the stern was the chief source of the evil. A minor modification of this dead-wood, with the rudder in its proper place, such as could be practically applied in the ship, likewise proved very tolerably effective, the average helm angle required being reduced to one-third of its amount.

On the strength of the results of these experiments, the Admiralty added a structure of this kind to the stern of the ship, with a result which, while it was a remarkable corro-

boration of the model experiments, was also on the whole a decided success from a practical point of view, the reduction effected in angle of helm being quite sufficient to qualify the ship to steam at full speed in a squadron and keep station satisfactorily.

EDWARD T. HARDMAN.

BY the unexpected death of this geologist, on the 30th ult., Irish Science has been deprived of one of her most promising followers. Mr. Hardman was born in Drogheda in 1845, and distinguished himself by the position he took at the Grammar School there, gaining a Government Exhibition and an entrance to the Royal College of Science in Dublin. He soon displayed his strong natural bent towards scientific pursuits, and when he quitted the College he had gained its diploma of Associate and taken a prominent place among its foremost students, more particularly in the departments of chemistry and geology. In 1870 he was appointed to the Geological Survey, and threw himself with characteristic ardour into the prosecution of field-work, while his knowledge of chemistry and mineralogy led to his being employed in special services where this knowledge was made available in the work of the Survey. His reports on the Tyrone and Kilkenny coal-fields are good examples of the extent of his knowledge and of his powers of literary expression. He also made his mark by the publication of papers outside the limits of official work. His interesting and suggestive memoir on the origin of Lough Neagh and his papers on anthracite and chert are well known.

In 1883 the Government of Western Australia applied to the Colonial Office for the services of a trained geologist to examine and report on the mineral resources and geological structure of the colony. Mr. Hardman was selected for the post, and obtained leave of absence from the Home Government to enable him to undertake the duties. He was absent upwards of two years, during which time he effected a preliminary survey of a wide tract of unexplored country, and made known its geological structure. In particular, he indicated the presence of gold, and pointed out the areas where gold-fields might be looked for. After enduring great hardships in the bush, he returned to this country, and resumed his duties in the Geological Survey. But the exposure in the Australian climate seems to have told upon his health. He had not been quite well during the spring, and at last he rapidly fell a victim to an attack of typhoid fever. We understand that arrangements had been nearly completed for recalling him permanently to take charge of the mineral surveys of Western Australia, when his sudden death occurred. He has left a widow and two children with no adequate provision, and his friends have already begun to take steps for collecting subscriptions for their behoof. Prof. V. Ball, of the Science and Art Museum, Dublin, and Dr. Henry Woodward, of the Natural History Department of the British Museum, Cromwell Road, S.W., have kindly undertaken to receive subscriptions.

NOTES.

THE Natural History branch of the British Museum in Cromwell Road has just received a most important donation from Lord Walsingham, consisting of a collection of Lepidoptera with their larvæ, mainly British butterflies (*Rhopalocera*) and certain families of moths (*Heterocera*), including *Sphingidae*, *Bombyces*, *Pseudobombyces*, *Noctua*, *Geometridæ*, and *Pyralidæ*. There is also a fine series of Indian species, collected and preserved at Dharmasala, in the Punjab, by the Rev. John H. Hocking, and specimens of exotic silk-producing *Bombyces* in

various stages of their development, obtained mostly from M. Wailly. With very few exceptions, the British larvæ, which retain a most life-like appearance, and are placed upon models of the plants upon which they feed, have been prepared and mounted by Lord Walsingham himself; the process adopted having been inflation of the empty skin of the caterpillar by means of a glass tube and india-rubber spray-blower over a spirit-lamp guarded by wire gauze. This has been found a simpler and quicker process, and one admitting of more satisfactory manipulation, than the alternative system of baking by means of heated metal plates or ovens. The specimens have mostly retained their natural colour, but in the case of the bright green species it has been found necessary to introduce a little artificial dry pigment. The whole collection consists of 2540 specimens of larvæ, belonging to 776 species, together with a series of the perfect insects of each species. As continued exposure to light is, unfortunately, most detrimental to the colours of insects, this collection cannot be exhibited permanently, but for the advantage of those who would like to see it without any restriction, it will be placed in the entrance hall of the Museum for a period of six weeks, including the Whitsuntide holidays and the Jubilee week in June.

THE Ladies' *Soirée* at the Royal Society will be held on June 8.

THE following men of science have been elected Foreign Members of the Linnean Society :—(Botanists) Dr. George A. Schweinfurth, Professor of Botany, Cairo, Egypt, whose travels and botanical researches in Central Africa are widely known; Count H. Solms-Laubach, Professor of Botany, University of Göttingen, whose observations on the Corallines, Gulf of Naples, and investigations in plant anatomy, especially that of flowering parasites, &c., are acknowledged biological contributions of merit; M. le Dr. Melchior Treub, Director of the Jardin Botanique, Buitenzorg, Java, whose studies among the Lycopods, Cycads, Lichens, &c., and whose labour in editing the "Annales du Jardin de Buitenzorg" are highly appreciated; (Zoologists) Dr. Franz Steindachner, Conservator of Herpetology and Ichthyology, Royal Museum, Vienna, distinguished for his very numerous and important memoirs on fish and reptiles generally; and Dr. August Weismann, Professor of Zoology, University of Freiburg, Baden, noted for his studies on the theory of descent, and embryological researches on insects and hydroids. Mr. William H. Beeby and Mr. Adolphus H. Kent, of London, and Mr. J. Medley Wood, of Durham, Natal, all three worthy workers in various departments of botany, have been elected Associates of the Society.

A LINNEAN herbarium has just been presented to the Upsala University by Prof. H. Sötherstrand, by whom it was inherited. It has been found by comparison of names to be a duplicate of that possessed by the Linnean Society of London.

THE Russian traveller, General Prijevalsky, is shortly to be presented with a gold medal by the Imperial Scientific Society of St. Petersburg, which has been specially struck, by order of the Emperor, in his honour. The medal bears on the obverse the initials of the recipient, and on the reverse the inscription "To the first student of the Natural History of Central Asia."

THE Paris Society of Civil Engineers offers a prize of 3000 francs for the best *diage* of Henry Giffard, the well-known aeronaut and inventor of the injector. This competition is open to foreigners, but the papers must be written in French.

ON Monday evening the session of the Institution of Mechanical Engineers was opened at the Institution of Civil Engineers, Great George Street, Westminster. The President, Mr. E. H. Carbutt, delivered the inaugural address, taking as his subject, "Fifty Years' Progress in Gun-making."

THE sixtieth meeting of the German Association of Naturalists will be held at Wiesbaden on September 18-24 next. A number of new scientific instruments and preparations will be shown. All inquiries are to be directed to Herr Dreyfus, 44 Frankfurterstrasse, Wiesbaden.

THE County of Middlesex Natural History and Science Society will hold their first annual *soirée* on Monday, the 23rd inst., at 11 Chandos Street, Cavendish Square. The chair will be taken at 8 p.m. by Lord Strafford, Lord-Lieutenant of Middlesex, and President of the Society. Objects of scientific interest will be exhibited.

THE total value of the fish landed upon the coasts of Scotland during the four months ended April 1887 was £343,337, being a decrease of £10,591 upon the corresponding period last year.

A COLLECTION of Indian cocoons is about to be sent by the Indian Government to Manchester, where it will be open for inspection. Infected cocoons are to be despatched to France for examination by M. Pasteur's pupils, who, it is hoped, will be able to suggest means for checking the disease which has nearly ruined the silk industry of India.

THE largest piece of amber ever discovered was recently dug up near the Nobis Gate, at Altona. It weighed 850 grammes.

THE ravages of the May-bug in Denmark have become so serious that a Bill is now under the consideration of the Danish Parliament proposing that the cost of the destruction of these insects shall be borne half by the State and half by local authorities.

THE Dutch Government intends to construct a railway in Sumatra, the cost of which will be nearly £1,400,000 (16,000,000 florins). The object is to facilitate the working of the coal-fields near the River Umbili. The coal deposit in these fields is reckoned to consist of about two hundred millions of tons.

AN interesting paper on "An Ideal Natural History Museum," read lately by Prof. W. A. Herdman before the Literary and Philosophical Society of Liverpool, has been issued as a pamphlet. Prof. Herdman calls attention to the strange fact that the Darwinian theory of evolution has had, as yet, little or no effect upon the structure and arrangement of museums of natural history. He urges that a phylogenetic arrangement would have the following advantages over the linear arrangement now employed in our museums :—(1) A phylogenetic arrangement would give a much more accurate representation of Nature. (2) While being more intelligible and instructive to the general public, it would be more in accord with the present state of biological knowledge, and could very readily be slightly altered from time to time so as to keep abreast with the progress of science. (3) It would be a perpetual illustrated lecture, of the best kind, demonstrating to everyone with ordinary intelligence the great doctrine of organic evolution.

ON April 14 about 9.15 p.m. a large meteor was observed at Thronhjelm, in Northern Norway. It went in a direction from north to north-east, and during its passage the light was so brilliant that the smallest objects in the snow were visible. It burst, as it seemed, into thousands of fragments, but there was no sound or report. Before bursting, the meteor was green, but during that process it displayed colours of red, yellow, and green, chiefly the latter.

M. E. FERRIÈRE has published a book called "La Matière et l'Énergie," summarising the latest results of physical investigation concerning matter and force.

THE second number of the "Jahrbuch der Naturwissenschaften" (a volume of nearly 600 pages) has just been issued. This useful periodical is edited by Dr. Max Wildermann, and pub-

lished by Herr B. Herder, of Freiburg-im-Breisgau. The present volume contains a clear and popular account of the work done in each of the sciences in the year 1886.

WE understand that the second part of the "Manual of Practical Botany," by Prof. Bower and Dr. Sydney Vines, will be published by Messrs. Macmillan and Co. in the course of a few weeks. It will include the Bryophyta and the Thallophyta; among the chief types used being *Polytrichum commune*, *Marchantia polymorpha*, *Polysiphonia fastigiata*, *Fucus serratus*, *Coleochaete scutata*, *Volvox globator*, *Agaricus campestris*, *Claviceps purpurea*, *Eurotium Aspergillus*, *Pythium de Baryanum*, and *Mucor mucedo*. Besides these a good many subsidiary types are used to illustrate special points.

"A CLASSIFICATION OF ANIMALS," drawn up by Mr. E. T. Newton for Mr. H. B. Woodward's "Geology of England and Wales," has now been issued separately. It is founded on the classifications proposed by Prof. Huxley, with such modifications as are, in the author's opinion, rendered necessary by recent discoveries.

THE Annual Report of the Royal Alfred Observatory, Mauritius, for the year 1885, has been issued. The mean temperature for the year at the Observatory was 73°·6. The highest reading was 86°·7 in February, and the lowest 57°·4 in July. Rain fell on 200 days, and amounted to 44·61 inches; the fall was below the average in the usually wet months of January to April, but above the average in the usually dry months of May to October. The island has not been visited by a hurricane since March 1879, although several cyclones have passed not far from it. The Report contains observations made at various stations in the island and at the Seychelles, and notices of storms in the Indian Ocean, collected from ships' logs. Photographs of the sun were also taken daily, when the weather permitted. There were 354 days on which it is certain that spots were on the sun's disk, and eight days on which it is certain that there were none. The number of spots in May was unusually great.

IN a recent book, "L'Enseignement actuel de l'Hygiène dans les Facultés de Médecine en Europe," Prof. Loewenthal, of Lausanne, shows that the time allowed per year for the teaching of hygiene varies from 20 minutes per week in England to 9 hours per week in Spain. The other countries range between these two extremes. The average is from 2½ to 3 hours per week for the whole year.

IN the May number of the *American Journal of Science* will be found a paper by Mr. Carey Lee, of Philadelphia, in which are described a remarkable series of salts of silver, which the author is attempting to make use of in obtaining photographs of objects in their natural colours. It is first shown, by an exhaustive series of experiments, that when light acts upon ordinary silver chloride, AgCl, in presence of hydrochloric acid, the darkening is due to the formation of a small quantity of subchloride, Ag₂Cl, which enters into combination with the unaltered silver chloride to form a reddish compound of a nature similar to that of a "lake." This red chloride of silver is termed protochloride, and is found to be, unlike subchloride, unattacked by cold strong nitric acid. After a certain amount of this substance is formed, the action of light appears to cease—a phenomenon which has been frequently noted by other observers. Successful efforts were then made to prepare protochlorides, bromides, and iodides of this nature, and a full description of the very numerous methods and analyses is given in the memoir. The startling fact was discovered that all varieties of tints from one end of the spectrum to the other could be obtained under suitable conditions. Normally, the protochloride of silver is red, even one-half per cent. giving to ordinary silver chloride a strong

coloration; but on exposure to diffused sunlight it quickly changes to purple. On addition of mercuric chloride it becomes gray, potassium bromide changes it to a permanent lilac, potassium iodide to a bluish tint, while a mixture of potassium chlorate and hydrochloric acid causes it to pass through pink and flesh-colour to pure white. Heat, on the contrary, causes it to retake its red coloration, and on exposure to various parts of the spectrum it affects lovely shades of the most varied hues. The important observation was made that, in presence of small quantities of lead or zinc chloride, white light (which darkens the pure protochloride) bleaches it, thus producing white in those portions of the image which ought to be white; and it was also found that the addition of a little sodium salicylate enhances the sensitiveness threefold. The experiments are being continued, and appear likely to lead to important results in chromo-photography.

THE current number of the *Auk* (vol. iv. Part 2) contains some interesting papers, but none of great importance. The want of finality in the system of nomenclature now practised by the American ornithologists is as marked as ever. Thus, Dr. Stejneger, having previously settled the synonymy of the redpolls, by the confounding of all received nomenclature, and the introduction of nine new synonyms into the already overburdened literature of six species, here furnishes a tenth hitherto unrecorded title for our British redpoll; and Mr. Brewster follows suit by adding another synonym to one of the American species of the same group. It might be well for ornithologists to consider whether the best plan would not be, as Mr. Seebohm advises, to simplify matters by accepting in every case the name that happens to have been for a long time most in vogue.

IN an interesting paper on the Ailsa Craig Lighthouse, read lately before the Scottish Institution of Engineers and Ship-builders, Mr. G. M. Hunter drew attention to the admirable system of illumination and signalling in the Firth of Clyde. There are Corsewall Point light, alternating white and red, at the entrance to Loch Ryan, distant from the Craig 17 miles; Sanda Isle light, off the Mull of Kintyre, distant 18 miles; Turnberry light, off the Ayrshire coast, distant 12 miles; Pladda light and fog-signals, off the southern end of Arran, distant 12 miles; and Holy Isle green and red light, distant 18 miles—all of which are revolving lights, with the exception of the fixed lights at Pladda and Holy Isle. These lights are all under ordinary circumstances visible from Ailsa Craig.

IN the *Ivestia* of the Russian Geographical Society there are some interesting remarks, by A. N. Krasnoff, on the history of the valley of the Ili River in Russian Turkestan. The Russian traveller considers that during the post-Pliocene age the valley of the Ili was nearly all occupied by water, and that the vegetation on the shores of this basin was quite different from that which exists now. It resembled, he thinks, the present vegetation of Middle Russia. There were forests of deciduous trees, among which maples, elm-trees, and apple-trees prevailed, and black-earth steppes occupied wide areas. Relics of this vegetation survive only at the foot of the snow-clad mountains, where they find the necessary moisture. Several of the species have there undergone remarkable adaptations, which permit them to support the rigorous continental climate. Deprived of the moisture of the snow-clad peaks, the vegetation of the lower ridges has completely changed since the recent desiccation of those parts of Asia. These ridges are covered now with a purely Central-Asiatic flora. As to the shores of Lake Balkhash and Ala-kul, they are either stony deserts with small grassy plants, or shifting sands covered with the characteristic Aral-Caspian bushes nearly destitute of leaves. The Balkhash was formerly a much greater lake than it is now, and it is rapidly becoming smaller. The depth of the Ala-kul Gulf has so far

diminished that the Kirghizes already ford the strait which connects it with the lake. None of the rivers given on our maps as flowing into the Ala-kul Gulf and Lake Balkhash from the south-west were found by M. Krasnoff. They have all dried up.

THE additions to the Zoological Society's Gardens during the past week include an Alexandrine Parrakeet (*Palaeornis alexandri*) from India, presented by Miss Ada Marshall; two Chinese Geese (*Anser cygnoides*) from China, presented by Miss Hoare; four Midwife Toads (*Alytes obstetricans*), South European, purchased; a Blue-cheeked Parrakeet (*Platyercus cyanogenys*) from North Australia; a Pied Crow Shrike (*Strepera graculina*) from Australia; a Sun Bittern (*Eurypyga helias*) from South America, received in exchange; a Blood-breasted Pigeon (*Phlogoenas cruentata*); two Dwarf Chameleons (*Chamaeleo pumilus*) bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

MICROMETRIC MEASURES OF JUPITER AND SATURN.—In the recently-published "Observations," made at the Hong Kong Observatory during 1886, Dr. Doberck gives some measures of Jupiter and Saturn made with the 6-inch Lee equatorial now at Hong Kong. The measures of Jupiter, extending from August 29, 1879, to April 7, 1886, include the position-angle of the polar axis, the apparent equatorial and polar diameters, the breadth of the equatorial belts and of the red spot, and the length of the latter when on the central meridian. Dr. Doberck concludes that the equatorial and polar diameters at the mean distance of Jupiter are $38''\cdot207$ and $35''\cdot942$ respectively, and that the equatorial semi-diameter at the mean distance of the earth from the sun is $99''\cdot39$. The measures of Saturn extend from January 3, 1879, to April 5, 1886, and include the position-angle of the polar axis, the external diameter of the ring, the diameter of Cassini's division, the internal diameter of the ring, and the equatorial and polar diameters of the planet. The deduced dimensions at the mean distance of Saturn are:—External diameter of ring $40''\cdot28$, diameter of Cassini's division $34''\cdot42$, internal diameter $26''\cdot82$, equatorial diameter of Saturn $17''\cdot22$, and polar diameter $16''\cdot53$. The equatorial semi-diameter at the mean distance of the earth from the sun is $82''\cdot11$.

PRESENT APPEARANCE OF SATURN'S RING.—M. Stuyvaert, Assistant-Astronomer at the Royal Observatory, Brussels, has recently presented a couple of drawings of Saturn to the Royal Belgian Academy. These were made on February 8 and 15 in the present year, and show the Cassinian division as encroaching on the outer ring, A, in a remarkable series of shaded indentations. Ring B is nearly broken up into a series of bright white spots by a number of dusky indentations on its inner border of a similar shape, and the dusky ring, C, likewise shows two dark notches on the inner side of the following ansa. Struve's division between B and C was also seen, and appeared on February 8 to be formed by a succession of dark gray spots. These observations are largely supported by those of Dr. Terby and Mr. Elger, published in the *Observatory* for March and April. Mr. Elger observed three or four "large re-entering angles like the teeth of a saw" on the inner margin of the dusky ring. This was on the preceding ansa, and not the following, as in M. Stuyvaert's observations, but the rotation of the ring would account for the change. Mr. Elger also noticed on February 25 that the preceding ansa of the dusky ring was unequally black, certain parts of its surface appearing quite black. These black spots were also noticed and drawn by Dr. Terby, who likewise remarked the unusual distinctness and breadth of Struve's division. It would appear, therefore, from these and other recent observations that the matter composing the ring system is at present much less symmetrically and evenly distributed than usual. Irregularities in the inner borders of the various rings, such as the above observers describe, have indeed been observed before, Trouvelot, for example, having remarked notches in Ring A, and Jacob similar indentations in the dusky ring, but they are not ordinarily seen.

THE RED SPOT UPON JUPITER.—From some recent observations of this object published by Mr. Stanley Williams in the May number of the *Observatory*, it appears that the ephemeris given

by Mr. Marth in the *Monthly Notices* for November 1886, is about a quarter of an hour too late. The red spot may therefore be expected to be on the central meridian at about the following times:—

	h. m.	h. m.	h. m.
May 24...	21 33	June 7...23 6	June 19...23 0
" 26...	23 11	" 10...20 35	" 22...20 30
" 29...	0 49	" 12...22 14	" 24...22 8
" 31...	22 19	" 14...23 53	" 26...23 46
June 2...	23 57	" 15...19 43	" 27...19 38
" 5...	21 27	" 17...21 22	" 29...21 16

The above times are expressed in Greenwich civil time, and are reckoned from midnight to midnight.

DISCOVERY OF A NEW COMET.—A new comet was discovered on May 12, by Mr. E. E. Barnard, Nashville, Tennessee, U.S.A. Place, May 12, 16h. 57m., R.A. 15h. 10m. 58s., Decl. $31^{\circ} 25' S$. The comet was only faint.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 MAY 22-28.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on May 22.

Sun rises, 4h. 1m.; souths, 11h. 56m. 24'6s.; sets, 19h. 52m.; decl. on meridian, $20^{\circ} 23' N$; Sidereal Time at Sunset, 11h. 52m.

Moon (New on May 22) rises, 4h. 18m.; souths, 11h. 38m.; sets, 19h. 9m.; decl. on meridian, $14^{\circ} 17' N$.

Planet.	Rises.	Souths.	Sets.	Decl. on meridian.
	h. m.	h. m.	h. m.	
Mercury ...	3 47	11 31	19 15	$18^{\circ} 38' N$.
Venus ...	6 17	14 47	23 17	$25^{\circ} 14' N$.
Mars ...	3 43	11 29	19 15	$18^{\circ} 56' N$.
Jupiter...	16 26	21 43	3 0*	$9^{\circ} 14' S$.
Saturn...	7 16	15 23	23 30	$22^{\circ} 8' N$.

* Indicates that the setting is that of the following morning.

May	h.	
26 ...	8	Venus in conjunction with and $5^{\circ} 18'$ north of the Moon.
26 ...	17	Saturn in conjunction with and $2^{\circ} 45'$ north of the Moon.
27 ...	14	Mercury in superior conjunction with the Sun.

Variable Stars.

Star.	R.A.	Decl.	h. m.
	h. m.		
U Cephei ...	0 52'3	$81^{\circ} 16' N$	May 24, $2^{\circ} 18' m$
U Canis Minoris...	7 35'2	$8^{\circ} 39' N$	" 22, m
δ Libræ ...	14 54'9	$8^{\circ} 4' S$	" 28, $2^{\circ} 44' m$
U Ophiuchi...	17 10'8	$1^{\circ} 20' N$	" 25, $1^{\circ} 48' m$
		and at intervals of 20 8	
W Sagittarii ...	17 57'8	$29^{\circ} 35' S$	May 28, $21^{\circ} 0' m$
η Aquilæ ...	19 46'7	$0^{\circ} 43' N$	" 27, $3^{\circ} 0' m$
R Sagittæ ...	20 8'9	$16^{\circ} 23' N$	" 28, m
R Vulpeculæ ...	20 59'4	$23^{\circ} 22' N$	" 22, m
δ Cephei ...	22 25'0	$57^{\circ} 50' N$	" 26, $3^{\circ} 0' m$

m signifies maximum; *m* minimum.

Meteor-Showers.

	R.A.	Decl.
Near α Draconis ...	280	$54^{\circ} N$.
γ Cygni ...	301	$37^{\circ} N$.
From Lacerta ...	329	$48^{\circ} N$.

GEOGRAPHICAL NOTES.

THE new *Ergänzungsheft* (No. 86) of *Petermann's Mittheilungen* contains a monograph of great importance in scientific geography by Dr. Rudolf Credner, Professor of Geography at Greifswald, on "Die Reliktenseen," which he defines broadly so as to include all lakes of marine origin, whether they do or do not now contain remains of marine fauna. The author considers such lakes of so great importance in connexion with the evolution of the earth, that he thinks it the duty of physical geography to critically examine all data concerning lakes which may have a claim to be regarded as of marine origin, and

decide whether such claim is justifiable. He discusses the evidences on which lakes may be regarded as of marine origin—historical, morphological, biological, and with regard to existing names. He then devotes considerable space to the discussion of the claims of lakes in all parts of the world to be regarded as of such origin; to the relations between salt- and fresh-water fauna; and to a critical examination of the faunistic argument for the marine origin of existing inland lakes. He concludes that none of the arguments derived from the considerations referred to have a convincing importance in deciding as to the marine origin of lakes. Dr. Credner is of opinion that the question can only be satisfactorily solved on the geological evidence furnished by the various lake regions; and this argument he means to develop in a second part of this very valuable monograph.

DETAILS are to hand of the recent exploration of the Mobangi tributary of the Congo, by Capt. van Gèle, which add something to the results obtained by Mr. Grenfell. Capt. van Gèle's journey was made at the end of 1886, at the time when the river is in flood, and when the current of the rapids is most powerful. At no part was the water less than 1·80 metre in depth, and the deepest did not exceed 11 metres. Not far from the embouchure of the Mobangi, on the left bank, 8° 30' S. lat., 17° 35' E. long., there is a French station. Above this part the Mobangi measures 2500 metres in breadth, 11 metres in depth in the centre, with a current at the rate of 1 metre per second. At the 4th degree N., just below the rapids, there is a breadth of 1200 metres, a depth of 7·50 metres, and a current of 1·50 metre per second. Between these two points the breadth of the Mobangi constantly varies, never exceeding 4000 metres. Its waters are of a clear brown colour, and its general aspect much the same as that of the Congo, its channel studded with islands, and its banks wooded. The right bank is often marshy, while the left bank is frequently steep, and the neighbourhood hilly. The left bank is much more densely peopled than the right, which never has but a scanty population. On the left bank, especially above the 2nd degree of latitude, there is a rapid succession of villages, belonging to the Baati, the Monyembo, and the Montumbi. The people are well made and tall (mean height of men 1·80 metre), they are industrious, but at the same time inveterate cannibals. In all the course of the river which has been observed, Capt. van Gèle did not notice any affluent of importance; the only three worth mentioning are the Nghiri on the left bank, and the Ibenya and the Loboy on the right. The Nghiri winds through a very marshy country, which probably occupies the place of the conjectural lake of that name. About 4° N. lat., a mountain mass is met with, running in a north-east and south-west direction, through which the Mobangi must penetrate in making its way to the Congo, and here it is, as might be expected, that rapids are found. The river here is narrowed into a gorge, impassable at high water, but, Mr. Grenfell assures us, quite passable at low water for a suitable steamer.

THE Argentines have been very active recently in the exploration both of Patagonia and of their section (the eastern) of Tierra del Fuego. In a communication which appears in *Petermann's Mittheilungen*, Ramon Lista gives some details of a journey which he made 'through the centre of the large eastern island from Sebastian Bay to the Strait of Le Maire. He states that our notions of the surface and climate of this island have hitherto been entirely erroneous: it has been regarded as inhospitable, barren, and uninhabitable; its rocky mountains covered with everlasting snow. This may be so with the west part of the land, but M. Lista gives a different account of the region traversed by him. From Cape Espiritu Santo to Cape Peñas he found valleys of varying breadth, covered with luxuriant fodder plants, and abounding in rivers, some of which are navigable, and which come from a snow-covered region in the interior. South of this is found the region of Antarctic forests. Though not so rich in grass and water as the northern region, M. Lista states that it made a favourable impression on him. He saw a good deal of the native population, and collected considerable data as to their anthropology. Many other scientific observations were made by him on the geology, fauna, and flora of the country.

THE Carniola section of the German and Austrian Alpine Club has resolved to put up on the Old Posthouse at Wurzen, the favourite head-quarters of Sir Humphry Davy, a tablet to commemorate his services in making known the South-Eastern Alps of Austria, and in attracting visitors thither.

THE ROYAL SOCIETY CONVERSAZIONE.

LAST week we referred to the *conversazione* of the Royal Society, held on Wednesday, the 11th inst. It was the best which has been given for many years. A large number of remarkable objects were exhibited, and an account of some of the most important of them may be of interest to our readers.

Prof. A. W. Rücker exhibited lecture apparatus to illustrate the measurement of coefficients of expansion by means of Newton's rings. The rings are formed between a glass plate and the convex end of a glass cylinder. These are pressed together by a metal frame, the front and back of which are connected by tubes through which a current of water is passed. The rings are projected on a screen and expand or contract when the temperature of the water is altered. The apparatus was shown in operation.

Maps to illustrate the present state of the magnetic survey of the British Isles now in progress, with a set of instruments of the Kew pattern, which have been used in the survey, were exhibited by Profs. Thorpe and Rücker. (1) Large map showing the stations at which observations have been made, and the values of three magnetic elements, viz. the inclination, declination, and total force at all places for which the reduction of the observations has been completed. The epoch of the survey is to be January 1, 1886, but the values given are not as yet corrected for secular change, except in the case of stations in Scotland. (2) Three maps of Scotland showing the lines of equal dip and equal total force for 1837, 1858, and 1886, and the lines of equal declination for 1858 and 1886. Mr. C. V. Boys exhibited a radio-micrometer and spinning-pile, which is probably the most sensitive instrument for measuring radiant heat yet made. It consists of a movable circuit of copper, antimony, and bismuth hung by a quartz fibre in a strong magnetic field. One-hundred-millionth of a degree is not beyond the possible limit of such an instrument. Prof. D'Arsonval made an instrument essentially the same in principle last year. This radio-micrometer was devised by the exhibitor without knowledge of M. D'Arsonval's, from which, however, it differs in important details. The one exhibited is an experimental instrument only; but it is about one hundred times as sensitive as a thermopile. The spinning-pile is peculiar in that it will start itself and turn either way indifferently when a spark is held on one side, and will at once stop when the spark is held on the other. Mr. Boys also showed an apparatus for shooting threads of glass, emerald, quartz, &c. A thin rod of the material is fastened to the tail of an arrow and heated at the end by an oxy-hydrogen flame. The trigger of a cross-bow is immediately pulled, and the arrow shot, when a thread of extreme fineness is drawn out. These threads are far finer than spun glass, and many are finer than spider-lines. Threads of quartz are practically free from elastic fatigue, and are most suitable for the torsion threads of instruments of precision. Quartz can be drawn so fine that the thinnest parts are beyond the power of any possible microscope to define them. Experiments were made, showing the discharge by flame of electrically-spun threads.

Sir John Fowler and Mr. B. Baker exhibited a series of most marvellous photographs of the 1700-feet span cantilever bridge now in course of construction across the Firth of Forth. Some of these photographs will be exhibited to-morrow at the Royal Institution. Specimens of wire and other articles made from "latinoid," manufactured by Mr. F. W. Martino, were exhibited by the London Electric Wire Company. Platinoid is untarnishable under atmospheric influences, and is specially suited to be a substitute for platinum-silver, German silver, &c., for electrical purposes, as by experiments it has proved itself unchanged under variation of temperature (see Proceedings of the Royal Society, No. 237, 1885). Major H. S. Watkin exhibited a Watkin patent aneroid invented by himself, and manufactured by Mr. J. J. Hicks. It is well known that aneroids have been made of all sizes, from 3 feet to half an inch in diameter; the length of the divisions on the scale representing inches on the mercurial barometer have also been varied to suit different purposes; but inasmuch as there was only one circle of figures, either the number of inches, and therefore the extreme height at which the instrument was available, had to be restricted, or the dimensions of the scale contracted in order to obtain a longer range. Major Watkin's patent index gets over this difficulty, and an open scale can now be obtained, combined with great length of range. Thus, in the 4-inch patent aneroid 1 inch on the mercurial barometer can be made to represent from 4 to 10 inches, and yet be available for great heights.

Captain Wharton, Hydrographer of the Admiralty, exhibited a sun-signalling apparatus, designed by Mr. F. Galton, F.R.S., for the use of naval surveyors. The optical arrangements are the same as those described by him in the *Journal of the British Association*, 1858, but the movements are new. Its advantage is the facility it affords for accurate direction of the beam of light; an image of the sun appearing over the object to which it is desired to flash, when viewed through the telescope. Capt. Wharton also showed a set of charts illustrating the hydrographical conditions of coral reefs and islands that stand in deep water; a new chart of the south circumpolar regions, with tracks of explorers; and a chart showing sea-surface temperatures obtained off the north-west coast of Spain, June to September 1886. An improved pneumatic tide-gauge or level-indicator was exhibited by Capt. de Wolski. This enables the registering apparatus to be at any distance, horizontal or vertical, from the spot in the sea below low-water mark where the tide is measured. Specimen charts (of which we have already given some account), exhibiting the conditions of weather over the Atlantic Ocean at the four seasons of the year, were shown by the Meteorological Council. (1) Daily synchronous charts of the North Atlantic in spring, February 27 to March 4, 1883. These charts show that an anticyclone lies over Western Europe, and the neighbouring part of the Atlantic, with much calm and fog prevailing at its centre; whilst the predominant winds in these islands are northerly and easterly, typical March weather. (2) Daily synchronous weather charts of the North Atlantic in summer, August 1 to 6, 1882. These charts exhibit the prevailing area of high barometrical pressure on the eastern side of the Atlantic, which is related to a prevailing north-westerly wind at the entrance of the Channel, changing to north off the coast of Portugal, and eventually merging in the north-east trade. (3) Daily synchronous weather charts of the North Atlantic, in autumn, October 9 to 14, 1882. The numerous small areas of low barometrical pressure over the sea on these charts, which appear at the time of year when the region of highest pressure is about to be transferred from the ocean to the land, seem to indicate what takes place during the change. Several small cyclonic systems are shown in the southern part of the area of high pressure which prevails over the Atlantic in about 30° N. (4) Daily synchronous weather charts of the North Atlantic in winter, February 9 to 14, 1883. The part of the Atlantic north of 40° N. is affected by a large area of low pressure, of which the centre lies somewhere to the southward of Iceland. These conditions are usual in winter. Maps of the English dialect districts, with key, by Mr. Alexander J. Ellis, to illustrate his "Existing Phonology of English Dialects," not yet published, were exhibited by the author. Mr. Frank Crisp exhibited early microscopes:—(1) Campani's microscope. No field lens, and probably the earliest microscope extant. (2) Pope Benedict's microscope. Belonged to Cardinal Lambertini, afterwards Pope Benedict XIV. Triple crown and cross keys inlaid in front of box. (3) Hooke microscope. This also belonged to the same Pope. (4) Oppelt's microscope. Instruments for measuring extensions and compressions in materials subjected to stress were exhibited by Prof. W. C. Unwin. (1) Apparatus to measure extensions to 1/10,000 of an inch. Two clips embrace the bar, so that the movement of the middle points is the mean of the extensions on both sides. The clips are set level by sensitive levels, and the distance between them is measured by a micrometer screw. (2) Apparatus to measure extensions. The bar is embraced by clips, so that a mean of the extensions on each side is taken. The extensions are measured by a roller and mirror. Measures to 1/100,000 of an inch. (3) Similarly arranged apparatus for compressions. The strain is measured by a microscope micrometer. Measures 1/50,000 of an inch. Apparatus for the drawing of automatic stress-strain curves was shown by Prof. Kennedy. In this apparatus the bar to be tested is extended "in series" with a much stronger bar of steel. This bar is used as a spring, and its elastic extensions, magnified by a light pointer, are taken as proportional to the stress in the test-bar, and recorded by the end of the pointer on a sheet of smoked glass which has a motion at right angles to that of the points, and proportional to the elongation of the test bar. There is also a special arrangement of differential levers to eliminate any errors in this motion which might arise from the extension or "give" of other parts of the instrument.

Forty-six photographs of clouds in many parts of the world were exhibited by the Hon. Ralph Abercromby, by whom they were photographed. These were mostly taken during two

voyages round the world for meteorological research. The pictures illustrate very clearly the identity of cloud-forms all over the world, for similar cumulus and cumulo-nimbus forms range in latitude from London to near Cape Horn—including one actually on the equator; and the stratus from Sweden to New Zealand; while the mists in the Himalayas are indistinguishable in general character from those of Great Britain. In addition to illustrations from the countries above mentioned, clouds are represented from Teneriffe, Brazil, the Falkland Islands, the Indian Ocean, and Borneo. Model of high-speed hydraulic or steam engine for driving electric light, and other purposes, was exhibited in motion by Mr. Arthur Rigg, the inventor. Reciprocation of pistons, and other moving parts, imposes an early limit to speed in engines of ordinary construction, so it has long been an unsolved problem how to produce a satisfactory engine without this evil, no rotary engines having ever yielded results encouraging their adoption. The revolving engine possesses pistons and cylinders, which are the best mechanical contrivance for remaining steam tight or water tight, and these have reciprocations relative as between each other, but only rotation in relation to the earth, while the cylinders and pistons revolve each on their own independent centres. The static balance and the dynamic balance are identical, and this engine therefore runs in equilibrium, without vibration, and in almost perfect silence. It is governed by varying the rate of expansion in the case of steam, or by varying the length of stroke in the case of water, and produces very economical results. It has none of that rhythmical variation in speed which occurs during each revolution of an ordinary engine. It is the only engine hitherto invented which can be driven at high speed by water pressures of considerable amount, and is found to give a perfectly steady incandescent light when making 250 revolutions per minute, driving a dynamo for 100 lamps, and worked by 700 lbs. per square inch water pressure. Prof. Forbes's thermo-galvanometer, made by Messrs. Nalder Bros. and Co., was exhibited by Prof. George Forbes. This consists of a ring, half of antimony, half of bismuth, one of the soldered junctions being filed thin and blackened to receive radiations. The conductivity of the ring is increased by the addition of a block of copper. A light Thomson magnet and mirror, suspended by a silk fibre, is placed inside the ring. The present form of instrument is rendered astatic by means of a second magnet. Prof. Forbes also showed specimens of electric welding by Prof. Elihu Thomson, of Boston, U.S.A. Some of Dr. J. Puluj's remarkable vacuum tubes, made by Müller, of Bonn, were exhibited by Mr. Warren De la Rue, and Dr. Hugo Müller. (1) Electrical radiometer with phosphorescent vanes. (2) Electrical radiometer with phosphorescent rotating disk. (3) Electrical radiometer with two phosphorescent rotating disks. (4) Electrical radiometer with rotating bell-glass. (5) Phosphorescent lamp. Specimens illustrating the effect of great earth-movements upon the pebbles contained in rock-masses were exhibited by Prof. J. W. Judd. (1) Series of impressed, faulted, crushed, and polished quartzite pebbles from the old red sandstone, near the great fault, Stonehaven, N.B. (2) Impressed limestone pebbles from the Swiss nagelfluhe. (3) Faulted, crushed, and re-cemented flint from the chalk. (4) Pebbles from Bunter conglomerate, crushed and scratched by earth-movements. Specimens and microscopic sections of carboniferous chert, filled with spicules of siliceous sponges, were exhibited by Dr. G. J. Hinde. Beds of chert are largely developed in the carboniferous rocks of Yorkshire, North Wales, and Ireland, between the horizon of the carboniferous limestone and the millstone grit. In Flintshire they attain a maximum thickness of probably not less than 350 feet. These strata are of organic origin, and built up mainly of the detached skeletal spicules of siliceous sponges, which, for generation after generation, lived and died on the sea-bottom in these areas, and by the gradual accumulation of their microscopic spicules formed the rocks. Maps and sections of the Geological Survey of the United Kingdom were exhibited by Mr. Arch. Geikie, and a MS. geological map of the British Isles, for the geological map of Europe now in preparation by the International Geological Congress, was shown by Mr. William Topley, of the Geological Survey of England. Scale, 1 : 1,500,000 (1 inch to 23½ miles). The map will be in forty-nine sheets, in all about 12 feet by 10 feet. The cost of producing the map is contributed by the various Governments of Europe. England's share of the expense is £400, instalments of which are given, as required, by the Royal Society from its Government grant. For this sum a hundred copies of the complete map will be sent to the Royal Society. A drawing of a specimen showing the assump-

tion of antenniform characters by the crustaceous ophthalmite, received from M. Alphonse Milne-Edwards, was exhibited by Prof. G. B. Howes. Mr. C. Baker showed Dr. Carl Zeiss's apochromatic objectives and eye-pieces, made of the new Abbe-Schott glass. The "Secohmmeter," a direct reading instrument for the absolute measurement of the coefficients of self and mutual induction, and for the absolute measurement of a capacity, was exhibited by Profs. Ayrton and Perry. On a future occasion we shall have something to say about this instrument. Mr. J. Norman Lockyer exhibited photographic comparison spectra of sun and metallic elements, taken at Kensington with Rowland grating. The metallic spectra were obtained in the usual way by putting metallic salts between the poles of an electric lamp. The lamp was placed at a distance of about 9 feet from the slit, and the rays of light diverging from it were rendered parallel by a lens of 9 inches focal length. An image of the sun was focused between the poles of the lamp by another lens of 10 inches focal length placed between the siderostat and the lamp. The light from the sun was thus sent through the slit under exactly the same conditions as that from the arc, so that both were brought to the same focus. The slit was covered with a piece of paper having four tongues, one of which was turned back for each exposure. The exposures varied from five to ten minutes. Mr. Lockyer also exhibited photographs of the spectra of compounds of carbon under various conditions, and a map showing the passage from flutings to lines in the spectrum of alcohol with increase of temperature, and the distribution of the various carbon flutings in the spectrum of the electric arc. The photographs, especially those of carbon dioxide, show how the spectrum of each compound depends upon the conditions of temperature and pressure to which it was subjected. A comparison of the spectra of different compounds will also show the general relations which exist between them; it will be seen that some of the flutings are special to certain compounds, while others are common to all. The accompanying map (approximately to a wave-length scale) represented the changes in the spectra of alcohol vapour produced by changes of temperature and pressure. The part of the map to the right of 4900 was mapped from eye-observations, and the remainder from the photographs. The lower half of the map shows the distribution of the carbon flutings in the spectrum of the electric arc, the spectrum of each portion of the arc being represented on the same horizon. A point of great interest is the appearance, in the flame which surrounds the negative pole, of three sets of flutings which shade off towards the red. The two most refrangible flutings shown in the alcohol spectra are apparently coincident with two of the five-membered ultra-violet group occurring in the spectra of the arc and cyanogen. Photographs of stellar spectra taken at Harvard College by Prof. Pickering (Henry Draper Memorial) were also shown by Mr. Lockyer. Spectra of α Lyrae, β Geminorum, α Cygni, α Tauri. These have already been referred to in NATURE. Twelve-inch Indian sun photographs taken at Dehra-Dun, India, March 4 and May 2, 1886, were exhibited by the Solar Physics Committee. The Rev. Dr. Pritchard showed (1) original negative of the Cluster in Perseus. Taken with the De la Rue reflector, 13 inches aperture; 120 inches focal length; exposure 30 minutes; diameter of plate-holder 6½ inches. This is one of a series of photographs taken in order to ascertain the greatest angular extent of the field, in which all the star impressions are free from deformation of circular contour. All the stars on this plate, even to the angular points, at a distance of 80' from the centre, are sensibly free from ellipticity. Positive enlargements on glass of the above. (2) The Macromicrometer presented by Dr. W. de la Rue to the Oxford University Observatory, carrying one of the original negatives of 61 Cygni, as used for the determination of the parallax of the two components of that star. (3) Original negative showing the photographic genesis of star impressions formed during varying durations of exposure, and viewed under high magnifying power. Dr. Edgar M. Crookshank exhibited micro-organisms:—(1) Microscopical specimens, including living micro-organisms and permanent preparations. (2) Cultivations on nutrient jellies, potatoes, &c., of the following micro-organisms:—

Bacillus tuberculosis.
Micrococcus tetrag. auus.
Bacillus typhosus.
Koch's comma-bacillus.
Fiukler's comma-bacillus.
Deneke's comma-bacillus.
Emmerich's bacterium.

Bacterium of rabbit septicæmia.
Bacillus of mouse septicæmia.
Bacillus of swine-erysipelas.
Bacterium of pneumonia (Friedländer).
Staphylococcus pyogenes albus.
Staphylococcus pyogenes aureus.

Staphylococcus pyogenes citreus.
Streptococcus of erysipelas.
Bacillus of anthrax.
Micrococcus prodigiosus.
Bacillus indicus.
Bacillus of blue milk.
Bacillus violaceus.
Bacillus pyocyaneus.

Red bacillus from water.
Red spirillum.
Black yeast.
Pink yeast.
Yellow sarcina.
Bacillus figurans.
Phosphorescent bacillus.

Water-cultures of the garden bean (*Vicia Faba*), the roots of which are infested with tubercular swellings, due to the parasitic action of a fungus, the extremely minute germs of which are common in the soil, were exhibited by Prof. H. Marshall Ward. Dr. E. Klein exhibited microscopic specimens and culture-tubes of the microbe of (1) foot-and-mouth disease; (2) scarlet fever; (3) several different forms of septicæmia; (4) swine plague.

THE METEOR OF MAY 8.

ON Sunday evening, May 8, at 8h. 22m., hundreds of people witnessed the flight of the brilliant slow-moving fireball, about which three letters were printed in NATURE last week. At the time of its appearance daylight was still so strong that only Venus, Jupiter, Saturn, and a few first-magnitude stars were visible in the firmament. At stations in the eastern part of England the fireball fell in the western sky; at Bristol and the west it descended in the east; while at Stafford it is described as falling in the south.

Descriptions of the apparent path and appearance of the meteor have been received from Eastbourne, Staines, Stafford, Hartfield near Tunbridge Wells, London, Clevedon, Bristol, &c. It is referred to by most observers as a strikingly brilliant object, in comparison with which the planet Venus looked small and faint.

The following are quotations from some of the reports which have reached me from various places:—

The Rev. F. B. Allison, of Eastbourne, says:—"An exceptionally bright fireball was seen to fall to-night [May 8] at 8h. 30m. There was so much light in the sky that I could only detect α and β Aurigæ. The meteor was considerably larger and brighter than Venus, of a bluish tint, with train of sparks, slow motion: 6 seconds over the path indicated." Mr. Allison sends a diagram, in which the observed part of the course is shown extending under α and β Aurigæ, at an angle of about 42° , to a length of about $24'$.

Mr. Francis Gare, of Staines, writes:—"The fireball was observed about 8h. 20m. to 8h. 25m., and was about half the size of the moon; its light was pale blue in colour, and was very bright, startlingly so. It left a train of red sparks about $6'$ long. The first part of its track was invisible to me as I was in a room with a S.W. window; this, too, would have prevented my hearing the detonation had there been any. The motion was slow." Mr. Gare sends a sketch, in which the fireball is represented as traversing 40° at an angle of 38° , and terminating 10° east of a line joining Venus and the horizon.

The Rev. E. Allen, of Castlechurch Vicarage, near Stafford, says:—"The time was within five minutes of 8h. 20m., May 8. It was so light that to see Spica as a reference-point, and whose place I knew exactly relatively to that of Jupiter, which was plainly visible, I had to fetch a binocular. The meteor was very large, and brilliantly white. Its light seemed to rise and fall in pulsations about two-fifths of a second in period, and its general power and effect was like what an extremely brilliant Roman candle ball would appear in somewhat deeper twilight at a distance of 50 or 60 yards from the spectator. Its motion was very slow, taking, I estimate, 5 seconds in passing along its total path of about $12'$ of arc. Estimating proportions of distance by eye, with the space between Jupiter and Spica as a guide, the path was something as follows: It was inclined about 25° to a perpendicular, the angle lying on the west, and fell from about R.A. 12h. 35m., Decl. $13^\circ 30'$ S., in a line nearly parallel to δ and ζ Corvi, and east of those stars."

At Hartfield, near Tunbridge Wells, the fireball was observed passing a little below Venus from right to left, and inclined 30° or 40° to the horizon. Duration, 3 or 4 seconds.

At Bristol, the meteor appears to have been pretty generally observed, and a large number of reports have come to hand. These, though differing in some essential particulars, sufficiently prove that the motion was from S.E. to E. by N. at an angle of 30° , the altitude at disappearance being about 20° . One observer describes it as being as large as a tennis-ball, and having a duration of 6 seconds. Another, who mentions the time as

8h. 20m., says that at disappearance it burst into a suppressed shower or halo of red; and a third relates that it travelled from S. to E. downwards, leaving two trains of sparks, and then finally bursting into fragments. It looked like an immense fire-work bomb, and many people, at the first impression, considered it so near as to mistake it for a large rocket. One observer avers that as the meteor burst he found himself enveloped in a "wave of heat" for several seconds!

Carefully comparing the descriptions of the path and direction, it is found difficult to determine with precision over what point of the earth's surface the fireball first became visible. Probably, however, this occurred above the English Channel, about 25 miles S.E. of the Isle of Wight, when the height of the body would be about 70 statute miles. From thence it slowly pursued a direction to the N.N.W., and entered the English coast over Gosport, after skirting the eastern boundary of the Isle of Wight. The meteor was descending to the earth at an angle of 30° ; at Gosport its height was 50 miles, and it afterwards passed over Winchester at an elevation of 38 miles, finally disappearing a few miles north of Swindon, when its height had further decreased to 14 miles.

This path apparently satisfies the majority of the observations, but there are, as usual, a few discordances. Thus, the Watford observation (NATURE, May 12, p. 30) gives an altitude of 30° for end-point in the W.S.W. (magnetic bearing). This seems far too great; about half, or 15° , would be consistent with the other observations. At Staines, where the altitude must have been nearly the same as at Watford, it was given as 13° , and at several places in London the altitudes are mentioned as 17° and less. Mr. Horner's observation at Montagu Street, W. (NATURE, May 12, p. 30) proves conclusively that the altitudes were very low. He saw the meteor first near γ Geminorum (alt. 23°), and it disappeared after moving slowly in the direction of Jupiter. If we adopt the end-point from this description as at $80^\circ + 16^\circ$, we get the terminal altitude as only 12° , which is in exact conformity with the adopted height of 14 miles at disappearance. The altitude of 17° from Highgate (NATURE, May 12, p. 30) is somewhat excessive, but it is well known that in estimates of this character the figures are nearly always too great. Lieut.-Colonel Tupman states: "Most persons (as has been often before remarked) guess altitudes at double what they really are, and 'the zenith' means anything higher than 45° or so" (see his paper on the great meteors of 1875, September 3, 7, and 14, Appendix, *Astronomical Register*, vol. xiv. p. 1).

The observations at Staines, Hatfield, and Montagu Street, W., are very fairly consistent as regards the direction of the meteor, and, taken in combination with the especially valuable notice from Stafford and the average of the Bristol observations, the radiant-point is found to have been situated in the S.E., altitude 30° , which is about 10° N.W. of Spica Virginis, or at $191^\circ - 5^\circ$. No definite meteor-shower is known from this point in May, though Heis gives a position at $191^\circ + 7^\circ$ for April 18 to May 18, which can hardly be the same. The great fireball of May 12, 1878, diverged from a radiant at $214^\circ - 7^\circ$, and it can scarcely be associated with that of May 8 last, as the two radiants are 23° distant.

The recent fireball had a real path in the atmosphere of about 110 miles. Its motion was very slow, but there are great discordances in the various estimates of duration. A large proportion of the observers only saw the latter part of the flight, but it would seem that the whole duration was fully 6 seconds, probably more, in which case the velocity was certainly less than 18 miles per second. The fireball, if moving in a parabola, would have had a velocity of 13 miles per second.

As to the actual size of this brilliant visitor, nothing can be definitely concluded, because it is impossible to discriminate between the glare and flaming effect of the nucleus and what extent of it represented the material diameter. The fireball was probably a very diminutive body, and much smaller than its conspicuous aspect would lead us to suppose. Had it withstood disruption and dispersion during another $1\frac{1}{2}$ second, it would have completed the remaining 28 miles of its path, and it must have fallen to the earth near Winchcombe, in Gloucestershire.

W. F. DENNING.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—We regret to hear that Prof. Prestwich has resigned the Chair of Geology which he has held for the last thirteen years.

CAMBRIDGE.—Last week the grace authorizing the Vice-Chancellor to enter into negotiation with Downing College with a view to securing a site for the Geological Museum in the grounds of Downing College, opposite the New Museums, was carried by eighty to seventy-one votes. Prof. Hughes, in a previous discussion, had objected to the site on the New Museum grounds because it would soon become too crowded. The Downing College site would afford plenty of room. Whether the University and the College can agree on the question of the price to be paid remains to be seen.

The Botanic Garden Syndicate have issued a modified report, proposing a different site for their necessary new plant-houses, namely, palm-house, stove, warm fern-house, and orchid-house, and recommending that authority be given them to obtain a detailed plan and estimate for building these, together with a new propagating-pit, the cost not to exceed £3000. They also strongly recommend the erection, in connexion with these houses, of a small research laboratory.

The examiners for the Adams Prize—the Vice-Chancellor, Prof. Stokes, Prof. Darwin, and Lord Rayleigh—have given notice that the subject for the Adams Prize to be adjudged in 1889 is "The Criterion of the Stability and Instability of the Motion of a Viscous Fluid." It appears from experiment (see Phil. Trans. for 1883, p. 935) that the steady motion in a tube is stable or unstable according as the velocity is less or greater than a certain amount; and it is inferred from theory, confirmed by experiment, that in two geometrically similar systems the motion is stable or unstable according as $\mu/\rho cU$ is greater or less than a certain numerical quantity n ; c , U being a length and a velocity which define the linear scale and the scale of velocity in the system, and ρ , μ the density and coefficient of viscosity of the fluid; but the quantity n has not hitherto been obtained even in a simple case except by experiment.

It is required either to determine generally the mathematical criterion of stability, or to find from theory the value of n in some simple case or cases. For instance, the case might be taken of steady motion in two dimensions between two fixed planes, or that of a simple shear between two planes, one at rest and one in motion.

Should the investigation not be found practicable for even a simple case of the motion of a viscous fluid, some substantial advance might be made in what has been done for a perfect fluid (see Proceedings of the Mathematical Society, vol. xi. p. 57), the title of the essay being modified accordingly.

The prize is open to all Cambridge graduates.

Each essay should be accompanied by a full and careful abstract, pointing out the parts which the author considers to be new, and indicating the parts which are to be regarded as of more importance than the rest.

The essays must be sent in to the Vice-Chancellor on or before December 16, 1888, privately. Each is to have some motto prefixed, and to be accompanied by a paper sealed up, with the same motto and the words *Adams Prize* on the outside, and the candidate's full name, with his College and degree, written within. The papers containing the names of those candidates who may not succeed will be destroyed unopened. Any candidate is at liberty to send in his essay either written (but not in his own hand) or printed or lithographed. The successful candidate receives about £170. He is required to print the essay at his own expense, and to present a copy to the University Library, to the Library of St. John's College, and to each of the four examiners.

SCIENTIFIC SERIALS.

The Quarterly Journal of Microscopical Science for March 1887, vol. xxvii. Part 4, contains:—On the termination of nerves in the liver, by A. B. Macallum (plate 36). These researches were made on the livers of man and Menobranchus (Necturus): the liver cells of the latter are from two to four times the diameter of those in man, and so were very favourable for these investigations; in man fibrils from the intercellular plexus of nerves give off excessively minute twigs, which terminate each in a delicate bead in the interior of the hepatic cells, near the nucleus; in Menobranchus the simple intracellular nerve-twigs always terminate in the neighbourhood of the nucleus, either singly or after branching, each terminal point being a delicate bead.—On the nuclei of the striated muscle-fibre in Necturus (Menobranchus) lateralis, by A. B. Macallum.—The development of the Cape species of Peripatus, Part 3: on the changes from Stage A to Stage F, by Adam Sedgwick, F.R.S. (plates

34-37). This elaborate memoir does not permit of being usefully summarised.—Morphological and biological observations on *Criodrilus lacuum*, by Dr. L. Örley.—Studies on earthworms, No. 3: *Criodrilus lacuum*, Hoffmeister, by W. B. Benham (plate 38). This little worm was first discovered by Fritz Müller in 1844, near Berlin, and was in the following year described by Hoffmeister; it was next found near Linz, and more recently in Italy and at Buda-Pesth by Dr. Örley, whose paper thereon has been translated from the manuscript by Mr. Benham. In the Danube this worm occurs, often in large numbers among the roots of *Stium latifolium*, the egg-cases looking like certain forms of *Enteromorpha*. The specimens dissected by Mr. Benham were sent to Prof. Lankester by Dr. Örley.—Notes on the chromatology of *Anthea cereus*, by Dr. C. A. MacMunn (plates 39 and 40). The pigments of *Anthea* are the pigments of certain marine Algae, and are without doubt the pigments of the "yellow cells" which are now known to be unicellular Algae.—On *Ctenodrilus parvulus*, nov. spec., by Dr. Robert Scharff (plate 41). This little Annelid was recently discovered by Mr. Bolton, of Birmingham, but its exact habitat is unknown.—On the relation of the Nemertea to the Vertebrata, by Prof. A. A. W. Hubrecht (plate 42); with permission, from Prof. Hubrecht's Report on the *Challenger* Nemertea.

American Journal of Mathematics, vol. ix. No. 3 (Baltimore, April 1887).—A memoir by Prof. Cayley on the transformation of elliptic functions, develops the algebraical theory established by Jacobi in the "Fundamenta Nova" (1829), and discusses other researches in this field by Jacobi, Briochi, and the writer (see Briochi's second appendix to his translation of Cayley's "Treatise on Elliptic Functions," and other papers cited in the present memoir).—Mr. G. P. Young contributes a long account of "Forms, necessary and sufficient, of the roots of pure uniserial Abelian equations"; and the number closes with some eighteen pages of tables under the heading "Symmetric Functions of the 14th," by W. P. Durfee,—these are arranged according to the second of the author's methods used in vol. v., where tables are given for the 12th. In vol. vi. it may be noted Capt. Macmahon does a similar work for the 13th.

In the numbers of the *Journal of Botany* for March and April, a species (or sub-species) of *Rubus* new to science is described by Mr. E. F. Linton, from Norfolk, under the name *R. lucens*, afterwards substituted by *R. latus*. The remarkable *Equisetum littorale*, differing from all other species of the genus in the absence of elaters, is recorded as British (and figured) by Mr. Beeby, on the faith of specimens from Surrey. Mr. Spruce concludes his elaborate description of his new species of Hepaticae, *Lejeunea Holtii*, from Killarney. The remaining articles are of merely local or technical interest.

THE number of the *Nuovo Giornale Botanico Italiano* for April is almost entirely occupied by articles of interest to Italian botanists. In addition to those referring to the distribution of species, Sig. L. Savastano has two short papers. The first refers to the parasitism of *Agaricus melleus*. From experiments made on a number of different trees, the author concludes that this fungus does not attack healthy trees, but only those that are weakly or diseased. In the second paper, on Gummosis, he adduces facts to show that this morbid phenomenon is to a large extent dependent on temperature, being less frequent in the northern than the southern portion of the zone of cultivation of any given species.

SOCIETIES AND ACADEMIES. LONDON.

Royal Society, May 5.—"The Proteids of the Seeds of *Abrus precatorius* (Jequirity)." By Sidney Martin, M.D. Lond., Pathologist to the Victoria Park Hospital. Communicated by Prof. E. A. Schäfer, F.R.S.

Two proteids were found in the saline extract of the crushed seeds; one a *globulin*, identical with that occurring in papaw-juice, and belonging to the group of vegetable paraglobulins; the other an *albumose*, identical with what the author has described as a *phytalbumose* in the papaw-juice. Attention was called to the differences between the class of vegetable paraglobulins and the vegetable myosins, which differ in the fact that the latter become readily changed into an albuminate when the sodium chloride holding them in solution is dialyzed away.

The investigation of the proteids is preliminary to that of their physiological action.

"Note on the Microscopic Structure of Rock Specimens from Three Peaks in the Caucasus." By Prof. T. G. Bonney, D.Sc., LL.D., F.R.S.

These specimens are from three localities in the Caucasus, all difficult of access, viz. the peaks of Tau Tetnuld, Guluku, and Elbruz. The first and second are peaks near together in the central part of the Caucasus; the specimens were collected in 1886 by Mr. W. F. Donkin. (1) Tau Tetnuld: one specimen from near the summit, representative of the rock forming all the upper part of the mountain. It is a mica-schist, which has been much crushed subsequent to its first crystallization. (2) Guluku: a series of rocks representing the upper part of the mountain—granitoid and gneissoid rocks and strong schists. These afford indications of more or less mechanical disturbance. In one, the garnets have been flattened out into elongated ovals, and ultimately cracked. The specimens indicate a succession of different rocks, possibly resulting from original stratification, though true granite probably forms part of the mountain. (3) From the western crater-peak of Elbruz, collected, in 1874, by Mr. H. Walker (from the highest rocks, more than 17,500 feet above the sea). It is a hornblende-andesite, not containing quartz, and thus is different from those on the lower part of the mountain.

Linnean Society, May 5.—Mr. W. Carruthers, F.R.S., President, in the chair.—Mr. E. W. Forrest, and Mr. G. Perrin were elected Fellows; Mr. W. H. Beeby, Mr. A. D. Kent, and Mr. J. M. Wood were elected Associates; Prof. G. A. Schweinfurth, Prof. H. Solms-Laubach, Dr. Franz Steindachner, Dr. M. Treub, and Prof. A. Weismann were elected Foreign Members of the Society.—The auditors chosen to examine the Treasurer's accounts were Mr. F. V. Dickins and Mr. G. Maw, to represent the Fellows, and Mr. J. E. Harting and Mr. A. D. Michael for the Council.—Mr. J. W. Willis-Bund exhibited specimens of the rainbow trout (*Salmo irideus*) reared in the fish-culture establishment, Delaford Park. Though from eggs of the same batch, the fish were very unequal in size. From the evidence of its being a migratory fish and other facts, Mr. Bund doubts the value of its introduction into this country as a stream trout.—Photos were shown and a letter read from Mr. J. G. Otto Tepper regarding a gall formation on *Scorvola spinescens* observed by him at Yorke's Peninsula, South Australia.—On behalf of Mr. W. Brockbank, there was exhibited photographs of a series of forms of *Narcissus reflexus* of Brotero, from Ancora, North Portugal, and grown in his garden at Didsbury. *N. reflexus* is ranked as a species by Nyman; but the variation in the Portuguese plant is so great in the size and shape of the corona, that it is evident no definite line of demarcation can be drawn between the Spanish *N. triandrus* and the Brittany *N. calathinus*. It would seem, therefore, that all the varietal forms of the section *Ganymedes* constitute a single species.—Mr. J. Harris Stone exhibited the flowers of *Nicotiana glauca* from Fuerteventura and Sanzarote, Canaries. The plant is a native of Buenos Ayres, where it grows 10 feet high. It seems to have been introduced into the Canary Islands about 1867-69, since which date it has run wild, and is now to be met with flourishing as a weed on the path sides and in the villages, attaining a height of 3 or 4 feet. The natives call it "mismo" (same), as spreading everywhere the same over the islands.—Photographs of the mud volcanoes of Trinidad, and of the Peak of Rakata, volcano of Krakatō, after the eruption, were exhibited respectively by Mr. R. V. Sherring and for M. Verbeek.—Mr. F. J. Hanbury called attention to specimens of hybrid *Primulas*.—A paper was read, viz. experimental observations on certain heterocercous Uredines, by Mr. Chas. B. Plowright. Among these, *Puccinia phalaridis*, *P. arenariicola*, *Gymnosporangium clavariiforme*, *G. juniperinum*, and *G. sabinae* more particularly engaged the author's attention; full details of the cultures and analyses of the experiments being given.—There followed a paper on *Vaccinium intermedium* as a new British plant, by Mr. N. E. Brown. It was discovered by Prof. Bonney at Cannock Chase, August 1886, growing plentifully in certain spots; *V. myrtillus* and *V. vitis-Idaea* being also abundant. Mr. Brown regards the plant in question as a hybrid between the two latter species, and to have originated independently at Cannock Chase, and not been introduced from the Continent.—A paper was read by Mr. R. A. Rolfe, on bigeneric orchid hybrids, the subject being treated chiefly with reference to its bearing upon classification. After pointing out that these hybrids, as in the case of those between species of the same genus, were more or less intermediate between the two

parents, the practice was recommended of compounding a name from those of the two parent genera, so as to avoid all confusion with existing genera. With regard to orchid hybrids generally, the following are the author's conclusions:—(1) Hybridization may take place not only between distinct species, but also between distinct genera, or between plants so structurally different as to be usually regarded as such. (2) These hybrids are generally of artificial origin, or accidentally produced, and cannot be treated in the scheme of classification either as varieties, species, or genera. (3) The possibility of hybridization taking place between species hitherto considered as distinct does not necessarily prove them to be merely forms of the same species. (4) The occurrence of a hybrid between two structurally different genera does not prove the necessity of uniting them in one; nor can such hybrids be arbitrarily referred to either of the parent genera. (5) Species and genera will always have to be dealt with in the scheme of classification according to their structural peculiarities and differences, without reference to the possibility of hybridization taking place between them.—A report was read, on the Alcyonaria of the Mergui Archipelago, by Mr. Stuart O. Ridley, in which a considerable number of new forms were described; the Burmese coast being rich in species bearing an Indian facies.

Zoological Society, May 3.—Dr. E. Hamilton, Vice-President, in the chair.—The Secretary read a report on the additions that had been made to the Society's menagerie during the month of April 1887, and called attention to two young Polar bears (*Ursus maritimus*) presented by Mr. Joseph Monteith; and to two crested ducks (*Anas cristata*) from the Falkland Islands, presented by Mr. F. E. Cobb.—Extracts were read from a letter addressed to the Secretary by Mr. Roland Trimen, respecting the obtaining of a second example of *Laniarius atrocereus* in South Africa.—Mr. J. Jenner Weir exhibited and made remarks on a skull of a boar from New Zealand.—A communication was read from Mr. G. A. Boulenger, containing the description of a new snake of the genus *Lamprophis*, based on a specimen living in the Society's Gardens, which had been presented to the collection by the Rev. G. H. R. Fisk.—A communication was read from Mr. J. H. Leech, containing an account of the diurnal Lepidoptera of Japan and Corea, based on a collection recently made by the author during a recent entomological expedition to those countries. The total number of species in Mr. Leech's list was 155. In Japan, Mr. Leech had discovered one new species (*Papilio mikado*), and in Corea four others.—Mr. R. Bowdler Sharpe, gave an account of a second collection of birds formed by Mr. L. Wray in the mountains of Perak, Malay Peninsula. This collection contained samples of about fifty species, of which ten were described as new to science.—Mr. H. J. Elwes pointed out the characters of some new species of diurnal Lepidoptera, specimens of which had been obtained by him during his recent visit to Sikkim.—A communication was read from Mr. Lionel de Nicéville, containing an account of some new or little-known Indian butterflies.

Entomological Society, May 4.—Dr. D. Sharp, President, in the chair.—The Rev. C. Ellis-Stevens, Mr. F. Merrifield, Mr. H. Rowland-Brown, and Mr. C. Matthews were elected Fellows.—Mr. Warren exhibited specimens of *Stigmonota pallifrontana*, *S. internana*, *Asthenia pygmeana*, and *A. abiegana* (*subsequana*, Haw.).—Mr. Stainton remarked that it was formerly thought that Haworth's *subsequana* was identical with the species previously figured by Hübner as *pygmeana*; but now that the two allied species were critically examined, it appeared that the species described by Haworth as *subsequana* was not *pygmeana*, but another species known as the *abiegana* of Duponchel, dating only from 1842, so that Haworth's name—*subsequana*—had priority by thirty years.—Mr. F. Pascoe exhibited a specimen of *Diachasma taylori*, taken out of the stem of an orchid—*Saccolabium caeleste*—received from Moulmein.—Mr. McLachlan exhibited nearly 200 specimens of Neuroptera, collected by Mr. E. Meyrick in Australia and Tasmania, comprising about seventy species. There were between forty and fifty species of Trichoptera, including forms from Western Australia, allied to *Plectrolarus*, and other species belonging to a group represented by *Hydropsyche edwardsii*. Among the Planipennia, the most remarkable insect was a species of the singular genus *Psychopsis*, from Mount Kosciusko, where it was common. Of Pseudo-Neuroptera there was a species of *Embiide* from Western Australia, and certain *Pocidae* and *Perlide*. Mr.

Meyrick made some remarks on the localities in which he had collected the species.—Mr. M. Jacoby exhibited a new species of *Xenarthra*, collected by Mr. G. Lewis in Ceylon.—Mr. C. O. Waterhouse exhibited a living example of an ichneumon—*Ophion micrurus*—bred from a larva of *Callosamia promethea*, a North American species. He also exhibited a number of wings of Lepidoptera denuded of the scales, in order to show the neurulation, and explained the method he had adopted for removing them. The wings were first dipped in spirit and then placed in *eau de javelle* (potassium hyperchlorite). Mr. Waterhouse said he had sometimes substituted peroxide of hydrogen for *eau de javelle*, but the action was much less rapid, although the results were satisfactory. Mr. Poulton remarked that the discovery of some chemical for softening chitine had long been wanted to prepare specimens for the microscope.—Mr. Slater read a note, extracted from the *Medical Press*, on the subject of the poison used by certain African Bushmen in the preparation of their arrows. It was stated that the poison was prepared from a caterpillar which they called "N'gwa."—The Rev. W. W. Fowler read a note received from Mr. J. Gardner, in which it was stated that *Dytiscus marginalis* possessed the power of making a loud buzzing noise like that of a humble-bee. Dr. Sharp said he was familiar with the humming of *Dytiscus marginalis* previous to flight, and thought it might perhaps be connected with an inflation of the body for the purpose of diminishing the specific gravity of the insect; he had noticed also that it was occasionally accompanied by the discharge of fluid from the body.—Mr. Wm. White read a paper on the occurrence of anomalous spots on Lepidopterous larvae.—Mr. Waterhouse read descriptions of new genera and species of *Buprestidae*.

Geological Society, April 27.—Prof. J. W. Judd, F.R.S., President, in the chair.—The following communications were read:—On the London Clay and Bagshot beds of Aldershot, by Lieut. H. G. Lyons, R.E. The author first described the section from Thorn Hill on the north to Redan Hill on the south, plotted from the 6-inch Ordnance Survey on a scale of 6 inches to 1 mile horizontal, and 12 inches to 1 mile vertical. This section comprises beds from the Woolwich and Reading series to the Upper Bagshot inclusive. The second section described runs from Gravel-Pit Hill on the north to Ash Green on the south. It was drawn to the same scale, and showed the beds from the Chalk to the Middle Bagshots inclusive. The third section was drawn, also on the same scale, through Aldershot town, showing the beds from the Woolwich and Reading series to the Middle Bagshots inclusive. It was inferred from various calculations, as also from direct observations, that the thickness of the London Clay shows no diminution throughout the section, being nearly the same also at Ash and at Aldershot Place. In "Caesar's Camp" the pebble-bed occurs at altitudes ranging from 505 to 550 feet. The author concluded that wherever we can fix the top or base of the London Clay we get a northerly dip of $2\frac{1}{2}^{\circ}$ to 3° , showing a fairly constant thickness of from 330 to 340 feet. The same thing occurs from Odiham on the west to Ash on the east, whilst at Brookwood the London Clay is thicker. He also assumed the existence of a passage from the London Clay up into the Bagshot beds in the deep wells or borings at Wellington College, at Brookwood, and at South Camp. Hence at these points there can have been no great erosion or unconformity. The overlying Bagshots lie conformably on the London Clay and on each other. The President congratulated the Society on the acquisition of a recruit whose carefully plotted sections did credit to his training as an officer of the Royal Engineers. The author's conclusions were discussed by Messrs. Irving, Whitaker, Monckton, Hudleston, and Herries.—Supplementary note on the Walton Common section, by Mr. W. H. Hudleston, F.R.S. The principal object of this paper was to point out the occurrence of certain beds of clay or loam in what are usually known as the "Lower Bagshot Sands" of West Surrey. The author maintained (1) that the more we study the Bagshot beds of this area the less likely are we to see a passage between the curiously diversified Lower Bagshots and the much more uniform and homogeneous London Clay; (2) that, until we realize the considerable though sporadic development of clays in the Lower Bagshots, we shall be in danger of referring beds to the Middle Bagshots which do not belong to them, and thereby give encouragement to a speculative stratigraphy which can only mislead. The reading of the paper was followed by a discussion, in which the President, Mr. Whitaker, Mr. Irving, and Mr. Herries took part.

Anthropological Institute, April 26.—Mr. Francis Galton, F.R.S., President, in the chair.—Mr. R. A. Cunningham exhibited some aboriginal Australians from North Queensland. The party consisted of a man, a woman, and a boy. They sang a corroboree song, and successfully showed the manner of throwing the boomerang.—Mr. C. H. Read read a paper on the ethnological bearings of the stone spinning-top of New Guinea, in which he gave a description of some spinning-tops recently presented to the British Museum.—Lieut. F. Elton, R.N., read some extracts from notes on natives of the Solomon Islands, obtained by him in reply to questions addressed to the solitary European resident on one of the islands.

PARIS.

Academy of Sciences, May 9.—M. Janssen in the chair.—A general method for determining the constant of aberration, by M. M. Léwy. A demonstration is given of the remarkable geometrical property that the action exercised by aberration on the great arc connecting two stars is in proportion to the cosine of the angle formed between the median and the direction of the motion. It is then shown that, by effecting two conjugated observations, the constant of aberration may be determined independently of any physical corrections.—On Admiral Cloué's second memoir regarding the cyclone which swept over the Gulf of Aden last year, by M. H. Faye. Some exceptional features of this destructive cyclone are described and accounted for, and it is suggested that a regular signal service should be established in Socotra, or at some other favourable point, for the protection of shipping in these much-frequented waters.—Researches on the liberation of ammonia by vegetable soils, by MM. Berthelot and André. The experiments here described have reference mainly to the argillaceous soil on the higher plateaux in the neighbourhood of Paris. They tend to show that vegetable humus possesses the property of spontaneously liberating ammonia in proportion to the slow but certain decomposition of the starchy and ammoniacal compounds contained in it. The decomposition is effected under the influence of the purely chemical actions due to the water and the earthy carbonates, and doubtless also to the physiological actions attributable to the fermentations, microbes, and vegetation properly so-called; causes continually at work in Nature.—On a method of recording the calorific intensity of the solar rays, by M. A. Crova. A study of the curves obtained with his registering actinometer has enabled the author to estimate more accurately the value of the methods employed for determining this quantity, and to study the causes of the diurnal and annual variations of atmospheric absorption. He promises soon to communicate the method adopted by him for the study of the actinometric curves and its application to the determination of the law of atmospheric absorption.—The earthquake of February 23, 1887, by M. Albert Offret. In supplement to his previous communication, the author here gives in tabulated form the exact time when the shocks were felt in various places lying beyond the line of general movement. Appended is a corresponding table for the magnetic disturbances recorded at different observatories lying mostly beyond the seismic area, but evidently produced under the influence of the earthquake. A comparative study of these tables gives the unexpected result that the velocity of the seismic waves increases with the distance from the central area of disturbance.—Study of the effects of an electric shock felt during the earthquake of February 23, by M. Onimus. A detailed account is given of the severe shock felt by a person at Nice while working the telegraph at the moment the third seismic wave occurred. The incident seems to place beyond all doubt the fact that earthquake movements are normally accompanied by strong electric currents.—On the two species of *Phylloxera* of the vine, by M. A. L. Donnadieu. The two species of this organism, hitherto confused under one form, are here carefully distinguished and described under the names of *P. vastatrix* and *P. pemphigoides*.—On the direct photography of the barometric state of the solar atmosphere, by M. G. M. Stanioéwitch. The author has made a comprehensive study of the solar photographs taken at the Meudon Observatory during the last eleven years, for the purpose of elucidating as far as possible the question of the origin of the solar photospheric network viewed in its relation with the solar pores, spots, and faculae. The general result is that this phenomenon is nothing but the direct photograph of the barometric maxima and minima of the solar atmosphere.—On synthetic acetic acid and its derived forms, by M. Louis Henry. The author's researches

show that monochlorureted acetic acid and malonic acid are essentially one, always identical with themselves, forming only a single variety whatever be the nature of the acetic acid from which they are derived.—On anemonine, by M. Hanriot. A full description is given of the properties of this neutral, non-nitrous substance, extracted by Hoyer from different anemones, some forty years ago, but since then entirely neglected by chemists.—On the creatines and creatinines, by M. E. Duvalier. This note deals mainly with the formation of α -amidocaprocyamine and α -amidocaprocyamidine.—Variations of the phosphoric acid in cows' milk, by M. A. Andouard. The object of this paper is to complete our knowledge of the modification which the composition of milk undergoes during lactation, and especially the variations occurring in the quantity of the phosphoric acid present during that period.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Anatomy of Movement: Dr. F. Warner (Paul).—Atlantic Weather Charts, part 2 (Eyre and Spottiswoode).—Die natürlichen Pflanzenfamilien, 3 and 4 Lief.: A. Engler and K. Prantl (Engelmann, Leipzig).—A Treatise on Geometrical Optics: R. S. Heath (Cambridge Press).—Saddle and Moccasin: F. Francis (Chapman and Hall).—Jahrbuch der Naturwissenschaften: Dr. Max Wildermann (Herder, Freiburg).—Proceedings of the Royal Society of Edinburgh, No. 122.—Naturæ Veritas: G. M. Minchin (Macmillan).—Schriften der Physikalisch Ökonomischen Gesellschaft zu Königsberg i. Pr. 1886 (Königsberg).—The Species of Ficus of the Indo-Malayan and Chinese Countries, part 1, Palaeomorphe und Urostigma: Dr. G. King (Reeve).—Notes from the Leyden Museum, vol. ix., No. 3 (Brill, Leyden).—Journal of the Chemical Society, May (Gurney and Jackson).

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